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BRONCHIECTASIS.[1]

By H. B. HARWOOD, M.B., Ch.M.,

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A good deal has been written about bronchiectasis during the past few years, but I think there are still a great many patients suffering from this disease who are not yet receiving treatment which will help to relieve them and enable them to carry on with their work more successfully as well as affording them a happier social existence. Tonight I shall make a *résumé* of the subject based on the recent literature and give an analysis of ninety-one consecutive cases in which I have used bronchoscopic treatment during the past four years.

Physiology.

The function of the tracheo-bronchial tree is to conduct the air to and from the lungs, to prepare the air finally for the lungs and to effect drainage of secretions and foreign material from the lungs. Normally, drainage is carried out by a number of contributing factors, including the action of the cilia, the action of the glands of the bronchial mucosa liquefying secretions, the respiratory movements, the tussive squeeze of the cough reflex and the blast of the cough itself.

The first movement in expelling foreign material from the lung is the tussive squeeze, by which this material is passed into the small bronchioles, from where it is moved on by air current and ciliary action to a position where it can be coughed up. Anything that hinders this movement will hinder the drainage of the lung. For example, pain from various causes, including that induced by operation, will prevent free respiratory movements, as also will such mechanical factors as fibrosis of the lung tissue and pleuritic adhesions.

There are two main factors which chiefly hinder the normal action of the cilia in passing the foreign material onwards. The viscidity of the mucus may be so great that it clings to the bronchial wall and the cilia are unable to wave it on. Also, when changes have occurred in the epithelium or in the bronchial wall itself, there will be interference with or destruction of the cilia and so obstruction to free drainage.

If material cannot be brought on by ciliary action to the larger bronchioles, the effect of cough will be inefficient. Even if material has been brought to an advantageous spot by tussive squeeze and the ciliary action, it will not be able to be coughed out unless an adequate quantity of air is moving at sufficient speed from a point distal to the obstructing mass.

Drainage depends also to a large extent on the liquefaction of the secretions by the action of the glands of the more normal bronchial mucosa. It has been found that sputum undergoes a series of changes in its course through the bronchi. In the lower bronchi its viscosity is greatest, and sometimes it will not be removed even with the help of postural drainage, but will require bronchoscopic aspiration. As this viscid sputum is passed on by the tussive squeeze, secretory pressure and respiratory movements, it becomes thinner through dilution and may be coughed out.[1]

In bronchiectasis the sputum in the tracheo-bronchial tree may be divided into three layers. These three layers are quite distinct from the three classic layers into which the sputum of bronchiectatic patients separates on standing.[2]

[1] Read at a meeting of the Section of Oto-Rhino-Laryngology of the New South Wales Branch of the British Medical Association on November 8, 1944.

The first layer or uppermost portion differs chemically and physically from the other layers. The sputum of the second layer is a diluted product of the sputum of the lower or third layer, and its viscosity is less than that of either the upper layer, which becomes drier, or the lower layer. The sputum of the third layer is very viscous and becomes even more so when removed from the bronchi and allowed to stand.

It is well recognized that the right lung receives foreign bodies or infective material more readily than the left lung, and it also drains more readily. Hence, infective material is more likely to remain in the left lung, and thus, we find bronchiectasis more commonly on this side.[3]

Ætiology.

There is still a certain amount of dispute whether such a condition as congenital bronchiectasis can or does occur, apart from what is generally known as congenital cystic disease. In all probability all bronchiectasis is acquired.

Most of the causes of bronchiectasis can be summed up under the following two headings: (*a*) defects in the bronchial wall, (*b*) the various stresses and strains to which the bronchial wall is subjected.[4]

Defects of the Bronchial Wall.

Most cases in the first category are probably due to some infective process acting on the bronchial wall, though other factors may also have some bearing on the production of the bronchiectasis. For example,[5] Lemoine has demonstrated interference with the nutrition of the bronchial wall by vascular disease of the bronchi and has also reported experiments to demonstrate the development of bronchiectasis after closure of the bronchial arteries. Recently, Sunder-Plasman has found that in cases of bronchiectasis the local nervous apparatus has been destroyed by inflammatory products, while Robinson has suggested that early paresis of the bronchial muscle, due to infection, will lead to dilatation, and if prolonged, to complete destruction of the musculo-elastic tissue.

Condon[6] has carried out investigations on the epithelium of the bronchi, and has shown that the epithelium is highly specialized and has the ability, under abnormal conditions, to alter its form and show rapid regenerative powers. Once altered in form, it always attempts to return to normal; but its power to do this is dependent entirely on the condition of the submucosa. When these destructive changes are advanced, frequently the elements are replaced by granulation tissue, which later becomes organized into scar tissue. All these destructive results of infection interfere with the normal drainage of the bronchi and favour the persistence and extension of the destructive processes.

Stresses and Strains of the Bronchial Wall.

It is likely that when the bronchial wall is weakened it may yield to the pressure of the retained secretions in the bronchus. Collapse of the lung also increases intrabronchial pressure, as the "cushioned" support of the aerated lung tissue, which is normally given to the bronchi, is removed when this occurs.

Continued inflammation causes interstitial fibrosis. The fibrotic area, by restricting the normal movements of the bronchi, by interference with the blood supply and by pulling on the lobular septa when it contracts, causes bronchiectasis to develop.

Bronchial damage may be caused by any respiratory tract infection. The original infection may be comparatively slight; but as Topley and Wilson[7] point out, it is the secondary infection which occurs either at the same time or later that is the main cause of the damage. Tannenberg and Pinner have shown in experiments that the infection itself does not cause bronchiectasis if it is not complicated by either complete or incomplete obstruction.

Certain of the specific fevers seem to predispose the subject, especially towards the development of bronchiectasis—for example, whooping-cough, measles, influenza and pink disease. Sinusitis is sometimes suggested as a predisposing cause, but this will be dealt with later.

It will be recognized that bronchial obstruction has quite a profound influence in the production of bronchiectasis. If bronchial obstruction is present, there is, of course, obstruction to the normal drainage. Leopold states that it is doubtful whether any type of bronchiectasis occurs in the absence of obstruction somewhere in the bronchial tree.

The smaller size of the trachea and bronchi in infants may be responsible for pronounced pulmonary changes due to obstructive lesions which would not affect the larger air passages of children or adults. Infants' bronchi are also more easily compressed. Duchen and von den Sperin state that in children the left bronchus is narrower than the right and is more easily compressed where it is crossed by the pulmonary artery.

Lesions which cause bronchial obstruction may be either intrabronchial, endobronchial or extrabronchial. The intrabronchial causes include foreign bodies and thickened exudate from an inflammatory lesion. Among the endobronchial causes are inflammatory swellings or cicatrical stenoses which may partially or completely occlude the bronchus, as well as tuberculous or specific lesions and also simple or malignant tumours which arise in or break through the wall. The extrabronchial causes may arise from any lesion that pushes on the bronchus from without to compress it.

Atelectasis is usually caused by straight-out plugging of the bronchus, or is due to collapse of the lung tissue from pressure below, followed by the formation of a bronchial plug from the stasis of the bronchial secretions. In cases of post-operative collapse, the lung or the bronchi are usually not normal, as then no secretions would be present to bring about bronchial obstruction. Any diminution of aeration of the lungs will predispose them towards atelectasis, and this, together with loss of cough reflex, will lead to stasis of secretions and blocking of the bronchus.

Bacterial Causes.

The bacteriological studies on bronchiectasis are not helpful, and one is forced to the conclusion that almost any organism which is known to produce lesions in the respiratory tract may be concerned. Some blame Vincent's organisms, others *Hæmophilus influenzæ* as a frequent cause of bronchial damage leading to bronchiectasis; but the extensive studies by Greey seem to prove that the great variety of organisms which may be found precludes the possibility of any predominating bacterial cause.

General Considerations.

Bronchiectasis is largely a disease of childhood, and when the history is traced back it will be found that the disorder has apparently followed on some predisposing condition that was present in the first few months or years of life. In infants and young children, the fact that the expulsive effort of the cough mechanism is much more feeble than in older children or adults favours the retention of obstructive secretions, and the condition for the establishment of bronchiectasis is ideal when the cough reflex is suppressed even more by the toxicity of the disease or by the sedatives which are so frequently given.[8]

Taking a classical picture, we find that, from the pathological point of view, a case of bronchiectasis is one in which either one or more of the larger bronchi are dilated, or several of the smaller branches. Bronchoscopically, it is one in which the visible bronchi are dilated or elongated, and radiographically, it is one in which we see dilatation of the bronchi, particularly with the aid of lipiodol instillation.[9]

The bronchiectatic area is usually the lower part of the lung. It may be bilateral and diffuse, unilateral or unilocular. When it is bilateral, one side is usually affected more than the other, generally the left.

There is a type of bronchiectasis which is often referred to as dry bronchiectasis; in it no symptoms except hæmoptysis may be present. While I have investigated a number of cases in which hæmoptysis of unknown origin was the only symptom, none have been found amongst them in which bronchiectasis could be demonstrated either

bronchoscopically or radiographically. The wet, suppurative type of bronchiectasis is the common form found, and is usually classified pathologically as fusiform, cylindrical or saccular.

Blades and Dugan[10] quote cases following atypical pneumonia, in which a temporary dilatation of the bronchi has been shown, and which they designate as of "pseudo-bronchiectasis".

Signs and Symptoms.

A common history in cases of bronchiectasis is that the patient had pneumonia or whooping-cough as an infant or young child and has always had some cough since. He is subject to colds and may have had further attacks of pneumonia of typical or atypical type, with variations in the amount of coughing and the amount of sputum when he grew old enough to cough it up instead of swallowing it, and he may sometimes have chest pains. Somewhere during this time it has been noticed that he has a running nose, and this condition also tends to persist.

Some of these patients at first glance may look well, and it is probably this fact which has accounted for their not seeking earlier investigation for their chronic cough. Others, whose pulmonary reserve is more affected, may find that even slight exertion causes moderate or severe dyspnœa. They may suffer from considerable fatigue and weakness, mental lethargy, anorexia and loss of weight, and may even become depressed and melancholic from their inability to work and to lead a normal social life. Cough may be distressing in some cases, and if it is present at night time, it may cause considerable loss of sleep. Cough may at times be dry and not productive, and at others large quantities of sputum may be coughed up.[11]

The sputum varies considerably in amount and character. It may be purulent or mucopurulent, and it may be liquid, though even in these cases it is usual to find some sticky pus in the lower bronchioles; on the other hand, it may be extremely sticky, and cling to the bronchus, to the trachea or to any vessel into which it is put. It may have no odour, but at times it is very foul and may cause the patient to be ostracized by his friends.

The patient may have nasal or post-nasal discharge, and perhaps nasal obstruction and headaches from sinus infection.

Hæmoptysis is a frequent symptom. It is sometimes the main symptom which causes the patient to seek treatment for his condition. Sometimes severe hæmoptysis occurs in cases of bronchiectasis, while in other cases it may amount to no more than some streaking of the sputum. Frequently recurrent attacks will be experienced.

Later, clubbing of the fingers may occur. In the earlier stages clubbing may consist only of an excess of tissue at the root of the nails, which may appear cyanotic or have an unnatural shine. Later still, the whole terminal phalanx may be involved; and it may become enlarged in all diameters, gross, clumsy and of "drumstick" appearance.[12]

More or less simultaneously with the extensive pulmonary fibrosis, secondary related changes of the thoracic cage may gradually develop, further limiting the respiratory function.

Nasal Sinusitis and Bronchiectasis.

It should be clearly recognized that in the larger proportion of cases of bronchiectasis there is some involvement of the nasal accessory sinuses. The theory of sinusitis as a cause of bronchiectasis is based on the assumption that infective material is aspirated from the nasal passages. This, of course, does occur, but probably acts only as a reinforcement of an existing infection.[13]

Radio-opaque substances have been seen by several observers to pass from the upper parts of the respiratory tract to the bronchial lumen,[14] and Price Thomas[15] has shown that when lipiodol is instilled into the nostril of a sleeping child, it can be demonstrated next morning by X-ray examination in the lower bronchi, most often on the left side.

In patients who are expectorating large quantities of purulent sputum the reverse may easily take place, and infection of the sinuses may be secondary to the bronchiectasis. Material at the level of the larynx has been proved to reach the naso-pharynx. After direct infection here, spread may quite readily occur along the nasal passages and so to the sinuses.[16] Probably, in most cases, however, the infection of the sinuses takes place at the same time as the infection in the chest, and a vicious circle may be established.

Prognosis.

It is, of course, well known that many patients with extensive bronchiectasis may live their normal life span and do so more or less comfortably; but this is perhaps the exception rather than the rule. The younger patients may sometimes be cured if treated early enough; but in the case of these occasional early or almost prebronchiectatic stages, our only prospect of a cure is by surgical means.

By organized treatment, however, we can considerably improve the health of these people. We can give them rest at night; they will gain in weight and lose their breathlessness; they will feel able to meet and associate with their fellows freely, and they will be able to return to their work or even to commence work which has been beyond them for years. In fact, their whole outlook on life will be improved.

There has always been a strong clinical impression that patients who develop bronchiectasis before the age of ten years are unlikely to live beyond the age of forty. Perry and King, in their analysis of 400 cases, found a certain amount of statistical evidence to support this, but at the same time they found some such patients in excellent health well beyond this age. While as a rule the prognosis for those with saccular bronchiectasis is poorer than for those with cylindrical bronchiectasis, and while it is also poorer for those with a bilateral lesion than for those with a unilateral lesion, these writers have found many in this category who remain well. Fœtid sputum and clubbing of the fingers are also looked upon as unfavourable signs.

The older text-books give the impression that brain abscess is one of the commonest causes of death in bronchiectasis; but perhaps atypical pneumonia and heart failure are much more frequent causes than intracranial lesions.

Diagnosis.

The diagnosis of bronchiectasis should be made early and correctly. I say this because apparently there are many patients among the community, labelled as suffering from chronic bronchitis, who will prove to be suffering from bronchiectasis. This is particularly likely in the less severely affected group—that is, the group that is suitable for surgical treatment. I have found on full examination of a number of patients who have had a cough for years and who have been sent up for sinus investigation, that bronchiectasis, which has not been suggested to the patient before, is also present.

Diagnosis is made partly by bronchoscopy and finally by X-ray examination with instillation of iodized oil observed both under the fluoroscopic screen during instillation and by the X-ray film. It is advisable that the iodized oil should be instilled into the bronchi under the screen so that one can observe how it enters the bronchi. It is characteristic of bronchiectasis that while in a normal area the iodized oil readily enters the bronchi, at times its passage down into a diseased area is delayed or impossible.

As later X-ray films are taken, the condition may be seen to have advanced—that is to say, sacculation may have occurred, but seldom will it be seen to have spread beyond the lobes or areas originally involved.

Bronchial obstruction or incomplete bronchial filling revealed in bronchograms may be due to several factors besides pathological lesions.[17] It may be due to imperfect injection, to an active cough reflex which expels the iodized oil before it reaches the terminal portions of the bronchi, or to excessive bronchial secretion. When the oil

is injected under the fluoroscope, any fault from these factors is more likely to be determined, and may perhaps be rectified. Thin over-all coating of the bronchi is preferable, and alveolar filling should be avoided as much as possible.[18]

Treatment.

Medical Treatment.

It is of the greatest importance to diagnose and treat prebronchiectasis—that is, before the pulmonary condition has produced permanent destruction and dilatation of the bronchial walls. The medical treatment of bronchiectasis is effective as a cure only before the pathological changes in the bronchi are irreversible. Prebronchiectasis may be assumed to be present when we find an area of dulness, bronchial breathing, râles, chronic cough and low-grade elevation of temperature, which has followed either an upper respiratory infection or so-called pneumonia. An X-ray picture taken at this time will probably confirm the diagnosis by showing an area of pneumonitis or atelectasis.[19]

In general, endless attention must be given to the general hygiene and diet. Active treatment of the upper respiratory passages must be undertaken, and all means of improving the lower respiratory drainage should be used. Also steps should be taken to try to minimize the frequency of acute nasal and pulmonary infections.

As far as climatic conditions are concerned, I have found that quite a large proportion of patients—at least 30%—who come to the clinic have first developed the condition in the country, and have lived their whole lives there without any benefit until they came to the city for treatment. I have found, though, that after a course of treatment, it is frequently beneficial for them to go into the country for a month or so, particularly for those who have been accustomed to a cramped and industrialized suburb.

Postural drainage, as shown by the experiments of Hermann, must be carried out for at least half an hour at a time. When starting this, the patient should cough vigorously for several minutes; but even then it is not so effective as bronchoscopic lavage, as can easily be shown by performing bronchoscopy and aspiration after postural drainage. After the bronchoscopic aspiration the relief is more immediate as well as more prolonged than after postural drainage. As postural drainage at night time usually increases the night cough, it is wiser to adopt this in the morning.

Chemotherapy is, of course, the latest to be tried; but there is not much reference to it in the literature. I shall deal with this more fully under the section on bronchoscopy, as most of the work has been done by local application or by bronchoscopy combined with oral administration of the drug. Stacey[20] has administered a 5% solution of sodium sulphathiazole placed in a nebulizer connected to an oxygen tank, the patient holding the nebulizer between the teeth and breathing through the mouth.

It should be obvious that there can be no success in the treatment of bronchiectasis if we do not include the thorough treatment of the upper respiratory passages. Any sinus infection should be dealt with early in the treatment. Removal of septic tonsils may be delayed till a later date when the patient has obtained some relief from other treatment.

My practice has been to investigate the sinuses straight away and to commence conservative treatment, such as by antral lavage, while carrying out a full investigation of the lungs by bronchoscopy and lipiodol injection. After this the patient has some bronchoscopic treatment before entering hospital for operation, which is carried out at a fairly early date.

After the clearing up of any sinus infection, the bronchiectatic patient usually has some diminution of coughing and less sputum, while his general condition improves, sometimes considerably.

With regard to expectorants, Holinger, Basch and Poncher,[21] as well as quoting Campbell and Poulton's experiments, carried out others themselves. They pointed out how slow, if it is unaided, was the dilution of the secretions, which is essential for pulmonary drainage. While confirming the fact that expectorant drugs and steam lowered the viscosity of expectorated sputum, they repeatedly found that the most dependent secretions, which are so largely responsible for destructive changes in the lower bronchi, were not influenced physically or chemically by these agents. As a result of their experiments, the efficiency of an atmosphere containing a high relative humidity as an expectorant was clearly demonstrated.

While the most constant influence noticed in the administration of expectorant drugs was the lowering of the viscosity of the sputum, the inhalation of steam was shown to liquefy it even more efficiently than the drugs. The action was found to be one of simple dilution, as the organic and inorganic content is also reduced. I have been accustomed in the clinic to rely on steam inhalations rather than on expectorants. Steam is usually used some little time before postural drainage is carried out.

Experiments with carbon dioxide showed that in concentrations of 4% or 5% it induced cough and helped to dislodge plugs of mucus. With these inhalations, it was observed that the viscosity of the sputum was regularly and noticeably lowered, and substantial reductions in the amount of sputum were also observed.

While oxygen alone acts so as to increase the viscosity of the sputum, if it is given with carbon dioxide the secretions become more liquid and less sticky. In bronchiectasis, carbon dioxide has been used by means of inhalation four or five times a day for five minutes at a time, and it has been found that not only is the viscosity lessened, but the organic and inorganic content is also reduced. This is the only "expectorant" which will accomplish these results. As well as acting as a direct expectorant, of course, carbon dioxide's action is to enforce deeper and more active respiratory movements, which help to evacuate the more dependent bronchi.

I have not carried out treatment with carbon dioxide, except at times when the patient is in hospital for some sinus operation, when "Carbogen" has been administered at intervals for the first twenty-four to forty-eight hours.

Bronchoscopic Treatment.

At the clinic all the patients are bronchoscopically examined, as the clinic is fundamentally a bronchoscopic clinic; but medical treatment is, of course, carried out as well, and selected patients are prepared for lobectomy.

The good results obtained from bronchoscopy are due to the removal of the sticky and obstructive secretion, to the freeing of clogged cilia where these are still present, to the opening up of the lumina which are stenosed by mucosal swelling, granulation tissue or fibrosis, and to the removal of any foreign body. The granulation tissue may be painted, cauterized or removed by forceps, and the narrowed orifices may be dilated with bronchial dilators, while the bronchi may be washed out and solutions may be instilled.[22]

The aim of these procedures is to permit the easier expulsion of secretions and to improve drainage and the power of defence of the bronchial system as well as the ventilation of the lung.[23] By this aeration and the removal of the infected material, which cannot be done by any other means, local deodorization also is promoted—a most important point for the patient.[24]

The cure of bronchiectasis by bronchoscopic treatment is rare, and can be expected only in recent cases. In all other cases we can expect only symptomatic improvement; but sometimes this improvement is pronounced. The frequency of treatment varies with each case.

All the clinic patients have been bronchoscopically examined under local anæsthesia, except two, who had a general anæsthetic for their first examination only, to make possible the taking of a good lipiodol X-ray picture for diagnostic purposes. These two patients were aged two and three years respectively, and for further treatments had no general anæsthetic.

Adult patients receive as premedication a hypodermic injection of one-eighth of a grain of heroin and one one-hundred-and-fiftieth of a grain of atropine half an hour before bronchoscopy. Corresponding doses are given to children according to their ages.

The anæsthetization of the patient must be good, both for the surgeon's ease and for the patient's comfort. Good anæsthetization is essential to obtain a good bronchogram. Our usual anæsthetic is a mixture of a 2% solution of "Decicain" (45 minims) and a 1 in 1,000 solution of adrenaline (15 minims). This mixture is used in spraying the lips, the mouth and the throat and over the larynx, and the remainder is instilled into the trachea. The quantity is reduced for children, while small children may receive only premedication and are wrapped up till sufficiently cooperative to lie quietly. In the case of children aged from five years onwards, it is usually necessary to restrain them for only the first two or three bronchoscopic examinations; after these they are generally extremely good and lie quite quietly during the treatment.

On the first occasion a complete bronchoscopic examination is made. The openings of the lesser bronchi are examined and noted for deviations, dilatations or stenoses. The presence of pus in each branch is noted, as well as granulations or congestion of the mucosa. In unilateral cases it is not unusual to find a little pus in the bronchus of the unaffected lung. Generally after aspiration the bronchus is washed out, and some more pus is then aspirated from the lower bronchioles. After this a catheter is put in, and the patient is then examined fluoroscopically while the iodized oil is injected, and a film is then taken. At this first examination a specimen of sputum is always taken for bacteriological examination, and a full blood count and estimation of the sedimentation rate are also made.

From data obtained at this first examination, the intervals at which the patient is to come for lavage are arranged. Most patients begin by coming once a fortnight, and as they progress this time is extended until they are quite comfortable, coming only about once in three months, and occasionally at even longer intervals, or after they have had a cold and feel as if they are "choked up".

For lavage different solutions may be used, such as saline solution or eusol. Many others have also been suggested. For some time I have been using the Bledsoe-Fischer[22] formula for all lavage. It is a solution containing sodium chloride, calcium chloride and potassium chloride. The amount of fluid used for lavage is not great; five to ten cubic centimetres are usually sufficient for each side.

Many drugs have been suggested for instillation into the bronchial tree after lavage, such as "Titrol" or "Merthiolate"[29] in a 10% aqueous solution *et cetera*. In some cases the injection of lipiodol or other iodized oil seems to be of some benefit also. I have not used any of these, apart from the iodized oils, and then only for diagnostic purposes; but I have tried some of the sulphonamide drugs.

There seems to be a good deal against the hope of much success from the local application of sulphonamide drugs in the bronchi. Firstly, they are expected to act in an area where there will soon be plenty of purulent material, even though lavage has just been applied. It is well known that the action of the sulphonamide drugs is greatly diminished in the presence of purulent material; but the addition of an oxidizing agent, such as a strong solution of iodine, partially destroys the inhibiting action of the *p*-aminobenzoic acid which is present in the purulent secretion.[27] Secondly, the action of the sulphonamide drugs is inhibited by the presence of a local anæsthetic agent, such as must be used in the bronchi before their instillation.[28]

For local application Osgood has shown that sulphathiazole is more effective than the other drugs and acts for a longer time. Fenton[30] has also pointed out that when sulphathiazole is applied to respiratory mucous surfaces in powder form, it does not stop the ciliary action, it disappears slowly and its absorption seems much delayed. This reaction of the cilia is also confirmed by Lierle and Evers[30] for sulphanilamide, sulphathiazole and sulphadiazine powders.

Norris has experimented with different methods of administration and claims to have achieved some success. In one series he injected microcrystalline sulphathiazole powder in Lugol's solution and distilled water. The sulphathiazole was found to be active in the bronchial secretion for from twenty-four to forty-eight hours, so this injection was repeated at intervals of two days. In another series sulphadiazine was administered by mouth for from four to fifteen days, and bronchoscopic drainage was performed every two to four days throughout the time during which the drug was being administered. The amount of benefit was calculated according to the amount of sputum by which the daily amount was reduced during the time of administration. The amount of sputum was measured carefully and checked every day. From his figures, Norris appears to have produced a pronounced reduction of sputum in some of his cases.

As our clinic is for out-patients, we have not been able to carry out any careful check-up of the amount of sputum, being forced to take the patient's estimate; nor have we had the opportunity of bronchoscopically examining the patients at more frequent intervals than once in seven days. On account of this, perhaps, our results with the use of sulphonamide drugs have not been very promising. However, patients have been given courses of treatment by sulphathiazole and Lugol's solution instillation, and also of treatment by sulphanilamide, sulphathiazole and sulphapyridine suspended in poppy-seed oil, and later, when that was unprocurable, in peanut oil. We are now beginning to try penicillin.

Surgical Treatment.

Surgical treatment offers us the only possible cure of well-established bronchiectasis—namely, by lobectomy. It is the work of the bronchoscopist to select patients who will be suitable to send to the thoracic surgeon for his final decision as to the advisability of operation. The bronchoscopist must also prepare the patient for operation.

The most suitable subject for lobectomy is the patient with a bronchiectatic lesion of only one lobe. Such a patient may be completely cured by operation. If more than one lobe is affected, it is preferable that the disease be confined to one side.[23]

In order that the mortality rate may be kept as low as possible, careful preparation must be made before operation. This is carried out by a routine course of treatment by bronchoscopic lavage, postural drainage *et cetera*, and by the clearing up of any sinus infection. This treatment will generally relieve the patient's symptoms considerably and render him a better surgical "risk". A patient with a large amount of sputum may have a "spill-over" to the other side, with some signs of acute infection. By bronchoscopy, we can relieve this and confine the secretion to the affected side, when the patient will be ready for operation.

The important point is, not the amount of secretion present in the lung condition, but where it is coming from. It is only by watching and treating the patient for some time that the bronchoscopist can truly evaluate this. Even though the bronchogram reveals a clear lobe, it must be carefully watched bronchoscopically before operation; particularly is this true of the lingula region.

Analysis of Cases.

I shall now discuss 91 consecutive patients whom I have treated up till the end of September, 1944. While some have been attending for four years, it must be noted that some have only had a few weeks' treatment.

All patients, on starting treatment, have been told that only improvement in health can be expected, as the only possibility of cure is that they may be brought to a stage at which they will be suitable for lobectomy.

Improvement has been based on the general health of the patient, on the diminution in the amount of sputum, on the reduction of breathlessness, on the lessened cough, on the more restful nights, on increase in weight, on capability of continuing at, returning to or commencing work, on increased social activities, and on a more normal blood picture and sedimentation rate.

The youngest patient was two years old and the oldest was aged seventy-one years. Between these limits the ages

The first layer or uppermost portion differs chemically and physically from the other layers. The sputum of the second layer is a diluted product of the sputum of the lower or third layer, and its viscosity is less than that of either the upper layer, which becomes drier, or the lower layer. The sputum of the third layer is very viscous and becomes even more so when removed from the bronchi and allowed to stand.

It is well recognized that the right lung receives foreign bodies or infective material more readily than the left lung, and it also drains more readily. Hence, infective material is more likely to remain in the left lung, and thus, we find bronchiectasis more commonly on this side.[3]

Ætiology.

There is still a certain amount of dispute whether such a condition as congenital bronchiectasis can or does occur, apart from what is generally known as congenital cystic disease. In all probability all bronchiectasis is acquired.

Most of the causes of bronchiectasis can be summed up under the following two headings: (*a*) defects in the bronchial wall, (*b*) the various stresses and strains to which the bronchial wall is subjected.[4]

Defects of the Bronchial Wall.

Most cases in the first category are probably due to some infective process acting on the bronchial wall, though other factors may also have some bearing on the production of the bronchiectasis. For example,[5] Lemoine has demonstrated interference with the nutrition of the bronchial wall by vascular disease of the bronchi and has also reported experiments to demonstrate the development of bronchiectasis after closure of the bronchial arteries. Recently, Sunder-Plasman has found that in cases of bronchiectasis the local nervous apparatus has been destroyed by inflammatory products, while Robinson has suggested that early paresis of the bronchial muscle, due to infection, will lead to dilatation, and if prolonged, to complete destruction of the musculo-elastic tissue.

Condon[6] has carried out investigations on the epithelium of the bronchi, and has shown that the epithelium is highly specialized and has the ability, under abnormal conditions, to alter its form and show rapid regenerative powers. Once altered in form, it always attempts to return to normal; but its power to do this is dependent entirely on the condition of the submucosa. When these destructive changes are advanced, frequently the elements are replaced by granulation tissue, which later becomes organized into scar tissue. All these destructive results of infection interfere with the normal drainage of the bronchi and favour the persistence and extension of the destructive processes.

Stresses and Strains of the Bronchial Wall.

It is likely that when the bronchial wall is weakened it may yield to the pressure of the retained secretions in the bronchus. Collapse of the lung also increases intrabronchial pressure, as the "cushioned" support of the aerated lung tissue, which is normally given to the bronchi, is removed when this occurs.

Continued inflammation causes interstitial fibrosis. The fibrotic area, by restricting the normal movements of the bronchi, by interference with the blood supply and by pulling on the lobular septa when it contracts, causes bronchiectasis to develop.

Bronchial damage may be caused by any respiratory tract infection. The original infection may be comparatively slight; but as Topley and Wilson[7] point out, it is the secondary infection which occurs either at the same time or later that is the main cause of the damage. Tannenberg and Pinner have shown in experiments that the infection itself does not cause bronchiectasis if it is not complicated by either complete or incomplete obstruction.

Certain of the specific fevers seem to predispose the subject, especially towards the development of bronchiectasis—for example, whooping-cough, measles, influenza and pink disease. Sinusitis is sometimes suggested as a predisposing cause, but this will be dealt with later.

It will be recognized that bronchial obstruction has quite a profound influence in the production of bronchiectasis. If bronchial obstruction is present, there is, of course, obstruction to the normal drainage. Leopold states that it is doubtful whether any type of bronchiectasis occurs in the absence of obstruction somewhere in the bronchial tree.

The smaller size of the trachea and bronchi in infants may be responsible for pronounced pulmonary changes due to obstructive lesions which would not affect the larger air passages of children or adults. Infants' bronchi are also more easily compressed. Duchen and von den Sperin state that in children the left bronchus is narrower than the right and is more easily compressed where it is crossed by the pulmonary artery.

Lesions which cause bronchial obstruction may be either intrabronchial, endobronchial or extrabronchial. The intrabronchial causes include foreign bodies and thickened exudate from an inflammatory lesion. Among the endobronchial causes are inflammatory swellings or cicatrical stenoses which may partially or completely occlude the bronchus, as well as tuberculous or specific lesions and also simple or malignant tumours which arise in or break through the wall. The extrabronchial causes may arise from any lesion that pushes on the bronchus from without to compress it.

Atelectasis is usually caused by straight-out plugging of the bronchus, or is due to collapse of the lung tissue from pressure below, followed by the formation of a bronchial plug from the stasis of the bronchial secretions. In cases of post-operative collapse, the lung or the bronchi are usually not normal, as then no secretions would be present to bring about bronchial obstruction. Any diminution of aeration of the lungs will predispose them towards atelectasis, and this, together with loss of cough reflex, will lead to stasis of secretions and blocking of the bronchus.

Bacterial Causes.

The bacteriological studies on bronchiectasis are not helpful, and one is forced to the conclusion that almost any organism which is known to produce lesions in the respiratory tract may be concerned. Some blame Vincent's organisms, others *Hæmophilus influenzæ* as a frequent cause of bronchial damage leading to bronchiectasis; but the extensive studies by Greey seem to prove that the great variety of organisms which may be found precludes the possibility of any predominating bacterial cause.

General Considerations.

Bronchiectasis is largely a disease of childhood, and when the history is traced back it will be found that the disorder has apparently followed on some predisposing condition that was present in the first few months or years of life. In infants and young children, the fact that the expulsive effort of the cough mechanism is much more feeble than in older children or adults favours the retention of obstructive secretions, and the condition for the establishment of bronchiectasis is ideal when the cough reflex is suppressed even more by the toxicity of the disease or by the sedatives which are so frequently given.[8]

Taking a classical picture, we find that, from the pathological point of view, a case of bronchiectasis is one in which either one or more of the larger bronchi are dilated, or several of the smaller branches. Bronchoscopically, it is one in which the visible bronchi are dilated or elongated, and radiographically, it is one in which we see dilatation of the bronchi, particularly with the aid of lipiodol instillation.[9]

The bronchiectatic area is usually the lower part of the lung. It may be bilateral and diffuse, unilateral or unilocular. When it is bilateral, one side is usually affected more than the other, generally the left.

There is a type of bronchiectasis which is often referred to as dry bronchiectasis; in it no symptoms except hæmoptysis may be present. While I have investigated a number of cases in which hæmoptysis of unknown origin was the only symptom, none have been found amongst them in which bronchiectasis could be demonstrated either

bronchoscopically or radiographically. The wet, suppurative type of bronchiectasis is the common form found, and is usually classified pathologically as fusiform, cylindrical or saccular.

Blades and Dugan[10] quote cases following atypical pneumonia, in which a temporary dilatation of the bronchi has been shown, and which they designate as of "pseudo-bronchiectasis".

Signs and Symptoms.

A common history in cases of bronchiectasis is that the patient had pneumonia or whooping-cough as an infant or young child and has always had some cough since. He is subject to colds and may have had further attacks of pneumonia of typical or atypical type, with variations in the amount of coughing and the amount of sputum when he grew old enough to cough it up instead of swallowing it, and he may sometimes have chest pains. Somewhere during this time it has been noticed that he has a running nose, and this condition also tends to persist.

Some of these patients at first glance may look well, and it is probably this fact which has accounted for their not seeking earlier investigation for their chronic cough. Others, whose pulmonary reserve is more affected, may find that even slight exertion causes moderate or severe dyspnœa. They may suffer from considerable fatigue and weakness, mental lethargy, anorexia and loss of weight, and may even become depressed and melancholic from their inability to work and to lead a normal social life. Cough may be distressing in some cases, and if it is present at night time, it may cause considerable loss of sleep. Cough may at times be dry and not productive, and at others large quantities of sputum may be coughed up.[11]

The sputum varies considerably in amount and character. It may be purulent or mucopurulent, and it may be liquid, though even in these cases it is usual to find some sticky pus in the lower bronchioles; on the other hand, it may be extremely sticky, and cling to the bronchus, to the trachea or to any vessel into which it is put. It may have no odour, but at times it is very foul and may cause the patient to be ostracized by his friends.

The patient may have nasal or post-nasal discharge, and perhaps nasal obstruction and headaches from sinus infection.

Hæmoptysis is a frequent symptom. It is sometimes the main symptom which causes the patient to seek treatment for his condition. Sometimes severe hæmoptysis occurs in cases of bronchiectasis, while in other cases it may amount to no more than some streaking of the sputum. Frequently recurrent attacks will be experienced.

Later, clubbing of the fingers may occur. In the earlier stages clubbing may consist only of an excess of tissue at the root of the nails, which may appear cyanotic or have an unnatural shine. Later still, the whole terminal phalanx may be involved; and it may become enlarged in all diameters, gross, clumsy and of "drumstick" appearance.[12]

More or less simultaneously with the extensive pulmonary fibrosis, secondary related changes of the thoracic cage may gradually develop, further limiting the respiratory function.

Nasal Sinusitis and Bronchiectasis.

It should be clearly recognized that in the larger proportion of cases of bronchiectasis there is some involvement of the nasal accessory sinuses. The theory of sinusitis as a cause of bronchiectasis is based on the assumption that infective material is aspirated from the nasal passages. This, of course, does occur, but probably acts only as a reinforcement of an existing infection.[13]

Radio-opaque substances have been seen by several observers to pass from the upper parts of the respiratory tract to the bronchial lumen,[14] and Price Thomas[15] has shown that when lipiodol is instilled into the nostril of a sleeping child, it can be demonstrated next morning by X-ray examination in the lower bronchi, most often on the left side.

In patients who are expectorating large quantities of purulent sputum the reverse may easily take place, and infection of the sinuses may be secondary to the bronchiectasis. Material at the level of the larynx has been proved to reach the naso-pharynx. After direct infection here, spread may quite readily occur along the nasal passages and so to the sinuses.[16] Probably, in most cases, however, the infection of the sinuses takes place at the same time as the infection in the chest, and a vicious circle may be established.

Prognosis.

It is, of course, well known that many patients with extensive bronchiectasis may live their normal life span and do so more or less comfortably; but this is perhaps the exception rather than the rule. The younger patients may sometimes be cured if treated early enough; but in the case of these occasional early or almost prebronchiectatic stages, our only prospect of a cure is by surgical means.

By organized treatment, however, we can considerably improve the health of these people. We can give them rest at night; they will gain in weight and lose their breathlessness; they will feel able to meet and associate with their fellows freely, and they will be able to return to their work or even to commence work which has been beyond them for years. In fact, their whole outlook on life will be improved.

There has always been a strong clinical impression that patients who develop bronchiectasis before the age of ten years are unlikely to live beyond the age of forty. Perry and King, in their analysis of 400 cases, found a certain amount of statistical evidence to support this, but at the same time they found some such patients in excellent health well beyond this age. While as a rule the prognosis for those with saccular bronchiectasis is poorer than for those with cylindrical bronchiectasis, and while it is also poorer for those with a bilateral lesion than for those with a unilateral lesion, these writers have found many in this category who remain well. Fœtid sputum and clubbing of the fingers are also looked upon as unfavourable signs.

The older text-books give the impression that brain abscess is one of the commonest causes of death in bronchiectasis; but perhaps atypical pneumonia and heart failure are much more frequent causes than intracranial lesions.

Diagnosis.

The diagnosis of bronchiectasis should be made early and correctly. I say this because apparently there are many patients among the community, labelled as suffering from chronic bronchitis, who will prove to be suffering from bronchiectasis. This is particularly likely in the less severely affected group—that is, the group that is suitable for surgical treatment. I have found on full examination of a number of patients who have had a cough for years and who have been sent up for sinus investigation, that bronchiectasis, which has not been suggested to the patient before, is also present.

Diagnosis is made partly by bronchoscopy and finally by X-ray examination with instillation of iodized oil observed both under the fluoroscopic screen during instillation and by the X-ray film. It is advisable that the iodized oil should be instilled into the bronchi under the screen so that one can observe how it enters the bronchi. It is characteristic of bronchiectasis that while in a normal area the iodized oil readily enters the bronchi, at times its passage down into a diseased area is delayed or impossible.

As later X-ray films are taken, the condition may be seen to have advanced—that is to say, sacculation may have occurred, but seldom will it be seen to have spread beyond the lobes or areas originally involved.

Bronchial obstruction or incomplete bronchial filling revealed in bronchograms may be due to several factors besides pathological lesions.[17] It may be due to imperfect injection, to an active cough reflex which expels the iodized oil before it reaches the terminal portions of the bronchi, or to excessive bronchial secretion. When the oil

is injected under the fluoroscope, any fault from these factors is more likely to be determined, and may perhaps be rectified. Thin over-all coating of the bronchi is preferable, and alveolar filling should be avoided as much as possible.[18]

Treatment.

Medical Treatment.

It is of the greatest importance to diagnose and treat prebronchiectasis—that is, before the pulmonary condition has produced permanent destruction and dilatation of the bronchial walls. The medical treatment of bronchiectasis is effective as a cure only before the pathological changes in the bronchi are irreversible. Prebronchiectasis may be assumed to be present when we find an area of dulness, bronchial breathing, râles, chronic cough and low-grade elevation of temperature, which has followed either an upper respiratory infection or so-called pneumonia. An X-ray picture taken at this time will probably confirm the diagnosis by showing an area of pneumonitis or atelectasis.[19]

In general, endless attention must be given to the general hygiene and diet. Active treatment of the upper respiratory passages must be undertaken, and all means of improving the lower respiratory drainage should be used. Also steps should be taken to try to minimize the frequency of acute nasal and pulmonary infections.

As far as climatic conditions are concerned, I have found that quite a large proportion of patients—at least 30%—who come to the clinic have first developed the condition in the country, and have lived their whole lives there without any benefit until they came to the city for treatment. I have found, though, that after a course of treatment, it is frequently beneficial for them to go into the country for a month or so, particularly for those who have been accustomed to a cramped and industrialized suburb.

Postural drainage, as shown by the experiments of Hermann, must be carried out for at least half an hour at a time. When starting this, the patient should cough vigorously for several minutes; but even then it is not so effective as bronchoscopic lavage, as can easily be shown by performing bronchoscopy and aspiration after postural drainage. After the bronchoscopic aspiration the relief is more immediate as well as more prolonged than after postural drainage. As postural drainage at night time usually increases the night cough, it is wiser to adopt this in the morning.

Chemotherapy is, of course, the latest to be tried; but there is not much reference to it in the literature. I shall deal with this more fully under the section on bronchoscopy, as most of the work has been done by local application or by bronchoscopy combined with oral administration of the drug. Stacey[20] has administered a 5% solution of sodium sulphathiazole placed in a nebulizer connected to an oxygen tank, the patient holding the nebulizer between the teeth and breathing through the mouth.

It should be obvious that there can be no success in the treatment of bronchiectasis if we do not include the thorough treatment of the upper respiratory passages. Any sinus infection should be dealt with early in the treatment. Removal of septic tonsils may be delayed till a later date when the patient has obtained some relief from other treatment.

My practice has been to investigate the sinuses straight away and to commence conservative treatment, such as by antral lavage, while carrying out a full investigation of the lungs by bronchoscopy and lipiodol injection. After this the patient has some bronchoscopic treatment before entering hospital for operation, which is carried out at a fairly early date.

After the clearing up of any sinus infection, the bronchiectatic patient usually has some diminution of coughing and less sputum, while his general condition improves, sometimes considerably.

With regard to expectorants, Holinger, Basch and Poncher,[21] as well as quoting Campbell and Poulton's experiments, carried out others themselves. They pointed out how slow, if it is unaided, was the dilution of the secretions, which is essential for pulmonary drainage. While confirming the fact that expectorant drugs and steam lowered the viscosity of expectorated sputum, they repeatedly found that the most dependent secretions, which are so largely responsible for destructive changes in the lower bronchi, were not influenced physically or chemically by these agents. As a result of their experiments, the efficiency of an atmosphere containing a high relative humidity as an expectorant was clearly demonstrated.

While the most constant influence noticed in the administration of expectorant drugs was the lowering of the viscosity of the sputum, the inhalation of steam was shown to liquefy it even more efficiently than the drugs. The action was found to be one of simple dilution, as the organic and inorganic content is also reduced. I have been accustomed in the clinic to rely on steam inhalations rather than on expectorants. Steam is usually used some little time before postural drainage is carried out.

Experiments with carbon dioxide showed that in concentrations of 4% or 5% it induced cough and helped to dislodge plugs of mucus. With these inhalations, it was observed that the viscosity of the sputum was regularly and noticeably lowered, and substantial reductions in the amount of sputum were also observed.

While oxygen alone acts so as to increase the viscosity of the sputum, if it is given with carbon dioxide the secretions become more liquid and less sticky. In bronchiectasis, carbon dioxide has been used by means of inhalation four or five times a day for five minutes at a time, and it has been found that not only is the viscosity lessened, but the organic and inorganic content is also reduced. This is the only "expectorant" which will accomplish these results. As well as acting as a direct expectorant, of course, carbon dioxide's action is to enforce deeper and more active respiratory movements, which help to evacuate the more dependent bronchi.

I have not carried out treatment with carbon dioxide, except at times when the patient is in hospital for some sinus operation, when "Carbogen" has been administered at intervals for the first twenty-four to forty-eight hours.

Bronchoscopic Treatment.

At the clinic all the patients are bronchoscopically examined, as the clinic is fundamentally a bronchoscopic clinic; but medical treatment is, of course, carried out as well, and selected patients are prepared for lobectomy.

The good results obtained from bronchoscopy are due to the removal of the sticky and obstructive secretion, to the freeing of clogged cilia where these are still present, to the opening up of the lumina which are stenosed by mucosal swelling, granulation tissue or fibrosis, and to the removal of any foreign body. The granulation tissue may be painted, cauterized or removed by forceps, and the narrowed orifices may be dilated with bronchial dilators, while the bronchi may be washed out and solutions may be instilled.[22]

The aim of these procedures is to permit the easier expulsion of secretions and to improve drainage and the power of defence of the bronchial system as well as the ventilation of the lung.[23] By this aeration and the removal of the infected material, which cannot be done by any other means, local deodorization also is promoted—a most important point for the patient.[24]

The cure of bronchiectasis by bronchoscopic treatment is rare, and can be expected only in recent cases. In all other cases we can expect only symptomatic improvement; but sometimes this improvement is pronounced. The frequency of treatment varies with each case.

All the clinic patients have been bronchoscopically examined under local anæsthesia, except two, who had a general anæsthetic for their first examination only, to make possible the taking of a good lipiodol X-ray picture for diagnostic purposes. These two patients were aged two and three years respectively, and for further treatments had no general anæsthetic.

Adult patients receive as premedication a hypodermic injection of one-eighth of a grain of heroin and one one-hundred-and-fiftieth of a grain of atropine half an hour before bronchoscopy. Corresponding doses are given to children according to their ages.

The anæsthetization of the patient must be good, both for the surgeon's ease and for the patient's comfort. Good anæsthetization is essential to obtain a good bronchogram. Our usual anæsthetic is a mixture of a 2% solution of "Decicain" (45 minims) and a 1 in 1,000 solution of adrenaline (15 minims). This mixture is used in spraying the lips, the mouth and the throat and over the larynx, and the remainder is instilled into the trachea. The quantity is reduced for children, while small children may receive only premedication and are wrapped up till sufficiently cooperative to lie quietly. In the case of children aged from five years onwards, it is usually necessary to restrain them for only the first two or three bronchoscopic examinations; after these they are generally extremely good and lie quite quietly during the treatment.

On the first occasion a complete bronchoscopic examination is made. The openings of the lesser bronchi are examined and noted for deviations, dilatations or stenoses. The presence of pus in each branch is noted, as well as granulations or congestion of the mucosa. In unilateral cases it is not unusual to find a little pus in the bronchus of the unaffected lung. Generally after aspiration the bronchus is washed out, and some more pus is then aspirated from the lower bronchioles. After this a catheter is put in, and the patient is then examined fluoroscopically while the iodized oil is injected, and a film is then taken. At this first examination a specimen of sputum is always taken for bacteriological examination, and a full blood count and estimation of the sedimentation rate are also made.

From data obtained at this first examination, the intervals at which the patient is to come for lavage are arranged. Most patients begin by coming once a fortnight, and as they progress this time is extended until they are quite comfortable, coming only about once in three months, and occasionally at even longer intervals, or after they have had a cold and feel as if they are "choked up".

For lavage different solutions may be used, such as saline solution or eusol. Many others have also been suggested. For some time I have been using the Bledsoe-Fischer[25] formula for all lavage. It is a solution containing sodium chloride, calcium chloride and potassium chloride. The amount of fluid used for lavage is not great; five to ten cubic centimetres are usually sufficient for each side.

Many drugs have been suggested for instillation into the bronchial tree after lavage, such as "Titrol" or "Merthiolate"[26] in a 10% aqueous solution *et cetera*. In some cases the injection of lipiodol or other iodized oil seems to be of some benefit also. I have not used any of these, apart from the iodized oils, and then only for diagnostic purposes; but I have tried some of the sulphonamide drugs.

There seems to be a good deal against the hope of much success from the local application of sulphonamide drugs in the bronchi. Firstly, they are expected to act in an area where there will soon be plenty of purulent material, even though lavage has just been applied. It is well known that the action of the sulphonamide drugs is greatly diminished in the presence of purulent material; but the addition of an oxidizing agent, such as a strong solution of iodine, partially destroys the inhibiting action of the *p*-aminobenzoic acid which is present in the purulent secretion.[27] Secondly, the action of the sulphonamide drugs is inhibited by the presence of a local anæsthetic agent, such as must be used in the bronchi before their instillation.[28]

For local application Osgood has shown that sulphathiazole is more effective than the other drugs and acts for a longer time. Fenton[29] has also pointed out that when sulphathiazole is applied to respiratory mucous surfaces in powder form, it does not stop the ciliary action, it disappears slowly and its absorption seems much delayed. This reaction of the cilia is also confirmed by Lierle and Evers[30] for sulphanilamide, sulphathiazole and sulphadiazine powders.

Norris has experimented with different methods of administration and claims to have achieved some success. In one series he injected microcrystalline sulphathiazole powder in Lugol's solution and distilled water. The sulphathiazole was found to be active in the bronchial secretion for from twenty-four to forty-eight hours, so this injection was repeated at intervals of two days. In another series sulphadiazine was administered by mouth for from four to fifteen days, and bronchoscopic drainage was performed every two to four days throughout the time during which the drug was being administered. The amount of benefit was calculated according to the amount of sputum by which the daily amount was reduced during the time of administration. The amount of sputum was measured carefully and checked every day. From his figures, Norris appears to have produced a pronounced reduction of sputum in some of his cases.

As our clinic is for out-patients, we have not been able to carry out any careful check-up of the amount of sputum, being forced to take the patient's estimate; nor have we had the opportunity of bronchoscopically examining the patients at more frequent intervals than once in seven days. On account of this, perhaps, our results with the use of sulphonamide drugs have not been very promising. However, patients have been given courses of treatment by sulphathiazole and Lugol's solution instillation, and also of treatment by sulphanilamide, sulphathiazole and sulphapyridine suspended in poppy-seed oil, and later, when that was unprocurable, in peanut oil. We are now beginning to try penicillin.

Surgical Treatment.

Surgical treatment offers us the only possible cure of well-established bronchiectasis—namely, by lobectomy. It is the work of the bronchoscopist to select patients who will be suitable to send to the thoracic surgeon for his final decision as to the advisability of operation. The bronchoscopist must also prepare the patient for operation.

The most suitable subject for lobectomy is the patient with a bronchiectatic lesion of only one lobe. Such a patient may be completely cured by operation. If more than one lobe is affected, it is preferable that the disease be confined to one side.[31]

In order that the mortality rate may be kept as low as possible, careful preparation must be made before operation. This is carried out by a routine course of treatment by bronchoscopic lavage, postural drainage *et cetera*, and by the clearing up of any sinus infection. This treatment will generally relieve the patient's symptoms considerably and render him a better surgical "risk". A patient with a large amount of sputum may have a "spill-over" to the other side, with some signs of acute infection. By bronchoscopy, we can relieve this and confine the secretion to the affected side, when the patient will be ready for operation.

The important point is, not the amount of secretion present in the lung condition, but where it is coming from. It is only by watching and treating the patient for some time that the bronchoscopist can truly evaluate this. Even though the bronchogram reveals a clear lobe, it must be carefully watched bronchoscopically before operation; particularly is this true of the lingula region.

Analysis of Cases.

I shall now discuss 91 consecutive patients whom I have treated up till the end of September, 1944. While some have been attending for four years, it must be noted that some have only had a few weeks' treatment.

All patients, on starting treatment, have been told that only improvement in health can be expected, as the only possibility of cure is that they may be brought to a stage at which they will be suitable for lobectomy.

Improvement has been based on the general health of the patient, on the diminution in the amount of sputum, on the reduction of breathlessness, on the lessened cough, on the more restful nights, on increase in weight, on capability of continuing at, returning to or commencing work, on increased social activities, and on a more normal blood picture and sedimentation rate.

The youngest patient was two years old and the oldest was aged seventy-one years. Between these limits the ages

run as follows: up to ten years, fifteen patients; between ten and twenty years, thirty-one patients; between twenty and thirty years, nineteen patients; between thirty and forty years, seven patients; between forty and fifty years, ten patients; between fifty and sixty years, five patients; between sixty and seventy years, three patients; and over seventy years, one case. Thus 46, or just over 50%, of the patients have been aged under twenty years; of these, 51 were females and 40 were males.

While seventy patients are still under treatment or observation, twenty-one have ceased to attend for various reasons. Of these, eight patients have disappeared after having treatment for an average of eight months each. Four of them had improved in condition and all had gained in weight—one, aged eighteen years, as much as 16·5 pounds. Two others have since notified us that they are completely relieved. Only two did not like the treatment and would not continue. Four others ceased to attend for various reasons. One returned to his old job as an instructor in the army, after having been discharged for bronchiectasis. One was called up for the Civil Constructional Corps, but has notified us that he wishes to return for treatment again next month. Two went to other States.

The five remaining patients of this 21 all died; one, aged twenty-one years, died after lobectomy, and three (aged respectively sixty-two, sixty-four and sixty-eight years) died from cardiac failure, and one died from carcinoma of the lung at the age of seventy-one years.

Twenty-six patients were unable to give any known cause for the development of their condition. The other sixty-five gave the following causes: pneumonia, twenty-five; whooping-cough, fifteen; hæmoptysis, four; bronchitis, four; pink disease, four; measles, three; broncho-pneumonia, two; measles and pneumonia, one; pertussis and pneumonia, one; influenza, one; foreign body, one; foreign body and pneumonia, one; scarlet fever, one; pleurisy, one; malignant disease, one.

In the pneumonia group, the age at which the patient suffered the attack was given as follows: from six to nine months, four patients; from one to ten years, eleven patients; from eleven to twenty years, four patients; from twenty-one to thirty years, one patient; from thirty-one to forty years, one patient; from forty-one to fifty years, three patients; from fifty-one to sixty years, one patient. Most of these patients will be seen to be in the early years of life. In the whooping-cough group, as would be expected, all cases occurred in patients aged under ten years.

The ages given as those at which symptoms were first noticed were as follows: up to ten years, 69%; from eleven to twenty years, 11%; over twenty years, 20%.

Only four patients had a lesion of the right side alone. Thirty-three had a lesion of the left side alone; in two cases the whole of the left lung was involved. In 54 cases both sides were involved. Hence in 87 cases, or over 96%, there was a lesion of the left lower lobe. Forty-six patients, or more than half, had saccular dilatation, and the remainder had fusiform or cylindrical dilatation in about equal proportion.

After the instillation of iodized oil, five patients showed some allergic reaction. It usually appeared as an urticarial rash, developing from three to ten days after the instillation of the oil into the lung.

The sputum at the commencement of the treatment was profuse in 24 cases, moderate (up to half a cupful in twenty-four hours) in 33 cases, and slight (up to an egg-cupful in twenty-four hours) in 34 cases. As has been stated before, the patients were out-patients, and reliance had to be placed on their own estimation of the amount of sputum. Sixty-six said that the amount of sputum was reduced after treatment; 58 of these are patients who have continued with the treatment. Of the 25 patients who stated that they had had no diminution in the amount of sputum, fourteen have continued with the treatment, but eight of these have been attending the clinic for less than twelve months.

Thirty-eight patients, or about 42%, had hæmoptysis before coming for treatment; in ten cases it was severe, in eleven moderate, and in seventeen slight. Seven patients first came to the clinic from fear caused by a recent hæmoptysis.

Seventeen patients had hæmoptysis during treatment; it mostly occurred on more than one occasion; one patient had as many as eight hæmoptyses in eighteen months, sometimes of severe extent. Four of these patients had not had previous hæmoptysis; but these had only slight streaking of the sputum.

Only 26% of the patients had any pronounced degree of clubbing of the fingers, but in several it was of gross type.

Nasal sinus infection was common. Seventy-one patients, or over 78%, had some degree of sinus infection. The sinuses most commonly affected were, of course, the antra, as is shown in the following statement:

One antrum only affected	10 patients
Both antra affected	30 patients
One antrum and one ethmoid sinus affected	1 patient
One antrum and one frontal sinus affected	2 patients
Both antra and one ethmoid sinus affected	3 patients
Both antra and both ethmoid sinuses affected	10 patients
Both antra, one ethmoid sinus and one frontal sinus affected	3 patients
Both antra, both ethmoid sinuses and one frontal sinus affected	4 patients
Both antra, both ethmoid sinuses and both frontal sinuses affected	8 patients

It is possible that some of the patients who are stated to have only the antra affected, may also have had some ethmoid sinus infection, as a number of patients had been subjected to operation before coming to the clinic, and no complete history on this point was available.

Operative treatment carried out on the nasal sinuses was as follows: double intranasal antrostomy (children), fifteen cases; single radical antrostomy, two cases; double radical antrostomy, twenty cases; double radical antrostomy and ethmoid curettage, eleven cases. This makes a total of 48 patients who had surgical treatment. The condition of others settled down with antral lavage, and a few are awaiting operation.

These patients are subject to colds, and 64, or 73%, reported colds during the course of treatment, some fairly frequently. Nineteen complained of pleuritic pains, sometimes on repeated occasions, and eight had pneumonia or pneumonitis during treatment. Four suffered from asthma and several children had measles and chicken-pox while attending the clinic.

Follow-up X-ray examinations have, on the whole, shown the condition to be at a standstill. Slight alterations can often be put down to differences in the filling of the bronchi with iodized oil. Five patients with early fusiform bronchiectasis diagnosed originally by X-ray examination have since been declared radiographically normal; all these have practically ceased to have any symptoms.

Twelve patients have been treated by the instillation of sulphonamide drugs into the bronchi. In several cases treatment was carried out for a prolonged time. The drugs used and the treatment given have been mentioned above. The only untoward symptom was occasional sickness for twenty-four hours after the use of peanut oil as a vehicle. A careful check was kept on the bacteriological condition of all these patients who were receiving injections; but I do not consider that we obtained any satisfactory results. I have now discontinued the instillations.

In an estimation of improvement in weight, it is found that 71 patients have gained in weight, nine showed no alteration or did not attend long enough for a check-up to be made, and eleven lost weight. The average loss of weight among these was three and a quarter pounds; this included three patients who died, three who had recently undergone double radical antrostomy and had not at the time picked up, and two who did not carry on with the treatment.

Among the 71 patients who gained in weight, the average increase was ten and a quarter pounds. Now, if we consider only those who have had more than twelve months' treatment, our average rises to twelve and a half pounds. The greatest gain in weight was two stone two pounds by a man, aged twenty-one years.

If the adults are separated from the children—that is, those aged up to twenty years and those aged over twenty years—we find that the younger people have gained on an average eleven pounds, while the older people have gained on an average five and three-quarter pounds.

Blood counts have usually been made in all cases every three months and sometimes more frequently. On an average, the total number of white cells was lower after treatment than before treatment. The average white cell count at the commencement of treatment was 9,300 per cubic millimetre and after treatment was 8,280 per cubic millimetre. There were many variations due to colds *et cetera*, and the highest count was 43,000 per cubic millimetre. A "shift to the left" of the neutrophile cells was found in thirteen cases.

In twenty cases, or 22%, anæmia was present, and in twelve of these it was found on repeated occasions after suspension of a course of iron treatment. The usual types of anæmia were normocytic normochromic, normocytic hypochromic and occasionally microcytic hypochromic. Only three of these patients had had hæmoptysis during treatment, and most quickly responded to iron.

The blood sedimentation rate was found to average around 10·5 millimetres. On the whole, there was a slight lowering of rate after treatment. It was found to rise as high as 22 millimetres and to fall as low as 3·0 millimetres, and in general, those patients with a consistently low sedimentation rate were found to be less severely affected than those with a high rate.

The sputum has been examined at regular intervals. The commonest organisms found in the aerobic cultures were: non hæmolytic streptococci, *Micrococcus catarrhalis*, pneumococci, *Streptococcus viridans*, hæmolytic streptococci, diphtheroids and *Staphylococcus aureus*. Also occasionally found were *Bacillus proteus*, *Bacillus subtilis* and *Bacillus pyocyaneus*, and in one case a pure culture of meningococci.

The anaerobic cultures yielded practically similar results. The fusiform bacillus was found in only 9% of the cases, and then only occasionally, while *Hæmophilus influenzæ* was found in 37% and Friedländer's bacillus in 23%. Monilia and yeast cells have been found occasionally.

Five patients have undergone lobectomy, and one patient came to the clinic who had undergone lobectomy five years earlier, but who still has some slight bronchiectasis of the lingula. These patients were operated on by Dr. B. T. Edye and Dr. John McMahon, and then returned to the clinic for check-up and observation.

And now as regards the patients' own opinion of the treatment and their condition. Those who have continued with the treatment say, practically without exception, that they feel improved in health and are glad to have had it. The difficulty has been to get them to agree to be transferred to attendance at longer intervals. Moreover, when the mothers of young children say that their children actually look forward to the day for bronchoscopic drainage, so that they may have their clogged bronchi washed out, the relief they obtain must be a real benefit and the treatment must be worth doing.

Selected Clinical Histories.

The following are some clinical histories selected from among those of clinic patients.

K.R., a female patient, aged nine years, had had a cough since an attack of whooping-cough at the age of ten months. Saccular dilatation is present at both lung bases. She has been under treatment for twenty-seven months. The amount of sputum is now less than half what it was before. Her general health has greatly improved, and she has gained one stone two and a half pounds in weight.

L.K., a female patient, aged eleven years, had had a cough following an attack of whooping-cough at the age of six years. Saccular dilatation is present at both lung bases. She has been under treatment for twenty-seven months. Her sputum was profuse; it is now greatly reduced. Her general health has improved, and she has gained one stone ten pounds in weight.

D.C., a female patient, aged twenty-one years, had had a cough following an attack of pneumonia at the age of nine months. Pronounced generalized saccular dilatation is present on both sides. She has been under treatment for fifty months. Previously she had had profuse sputum, and was always tired, breathless and unable to work. The amount of sputum has now been diminished by half, and her general health is good. She can play any sport for any length of time, and has been working overtime for the past two years. She has gained one stone nine and a half pounds in weight.

J.T., a male patient, aged twenty-six years, had had a cough since an attack of pneumonia at the age of nine months. Saccular dilatation was present at both lung bases. He has been under treatment for twenty-one months. His sputum is now less and he feels better. He has given up his invalid pension and started work, and has gained three and a half pounds in weight.

I.S., a female patient, aged twenty-seven years, had had a cough since an attack of whoopng-cough at the age of ten years. Gross saccular dilatation was present at both lung bases. She has been under treatment for fifteen months. Her sputum is still profuse, but she feels better and has started work for the first time for many years. She has gained six and three-quarter pounds in weight.

G.D., a female patient, aged forty-one years, had had a cough since an attack of whooping-cough in childhood. At her first examination she also stated that she had had "pneumonic 'flu" three months before her baby was born; the baby was then five weeks old. The first X-ray examination revealed pronounced saccular dilatation of the lower lobes of both lungs. She has been under treatment at intervals for twenty-seven months. The next three X-ray films revealed no alteration in the bronchiectatic appearance at the base of the left lung; but the dilatation at the base of the right lung has completely disappeared. Her sputum has diminished in amount, she can do much more, she feels better, and she has gained one stone four and a half pounds in weight.

I believe that the lesion on the left side dates back to her childhood illness, while that on the right side may have followed the atypical pneumonia from which she suffered just before her baby arrived, and has thus responded to early treatment.

Prevention.

This finally brings us to what is, in my opinion, the most important point in regard to bronchiectasis; that is, the extreme importance of trying to diagnose prebronchiectasis and so being in a position to carry out suitable treatment which will have some chance of preventing the development of irreversible bronchiectasis.

Bronchiectasis is always a serious disease, and is sometimes fatal; but it still does not seem to receive the attention which it deserves.[22] If taken early enough, in some cases it should be preventible and in occasional cases it should be curable. Since much of it can be prevented by early recognition and treatment, the responsibility for this must generally fall on the general practitioner, who is usually the first to see these patients. In general, the earlier that treatment is undertaken, the better are the chances of recovery.[23]

Patients suffering from whooping-cough, measles, influenza and pink disease are subject to secondary pulmonary infections, and therefore all care should be taken to guard them against these. They should have their general resistance built up, and the earliest signs of delayed cure should be thoroughly investigated immediately. All patients who are left wth a chronic productive cough should be fully examined, both bronchoscopically and bronchographically, before they are labelled as suffering from chronic bronchitis or sinusitis.

Anspach[24] has demonstrated that atelectatic areas may be seen in the X-ray films of many of the patients, and has shown that bronchiectasis will develop in these areas if they remain atelectatic. Therefore, all patients who have an acute pulmonary infection following the diseases mentioned above, should be followed carefully until the condition has completely settled. This is particularly true

of atypical pneumonia in children, in whose case a complete settlement of the condition should be verified by X-ray examination. One of the difficulties lies in recognizing the importance of apparently insignificant physical findings, as the child often appears to have recovered from his acute pneumonia and is up and about, but still has a persistent cough and may also have a slight elevation in temperature.

In many cases in which the atelectasis has occurred for the first time, it will clear up spontaneously with the help of postural drainage and the use of expectorants to help out the sticky sputum. In these cases sedative cough mixtures are contraindicated. Holinger considers that this type of occurrence may be repeated on several occasions, and that after each attack the collapse may be of longer duration and may finally become permanent.

It is possible, by performing bronchoscopy in those cases in which spontaneous recovery does not occur, to establish drainage and so to prevent bronchiectasis. The necessity for bronchoscopy may not always be apparent on physical examination or from the history alone; but an X-ray examination frequently reveals the necessity for such investigation and treatment. Chevalier Jackson contends that if early resort to bronchoscopic aspiration was substituted for the use of opium derivatives, fewer cases of chronic suppuration, bronchiectasis and lung abscess would follow pulmonary infection.

Now, as Hinshaw and Schmidt suggest, if a similar attitude as that towards tuberculosis was taken towards acute infections which resemble pneumonia and influenza, and particularly towards those apparently slight pulmonary infections during the early years of life, especially those following the infectious fevers, it should be possible to prevent large numbers of cases of bronchiectasis. Hinshaw and Schmidt most strongly suggest that all patients with acute pulmonary infections should be followed radiologically after clinical recovery, and that clinical judgement should be guided by X-ray findings in the management of these patients, as is now the case in tuberculosis. I am convinced that if this was done as a routine measure, and if early use was made of bronchoscopic examination and treatment, we should be well on our way to reducing the number of cases of bronchiectasis. But we must not forget that this treatment has to be carried out in the early stages, before irreparable damage has been done.

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THE CLINICAL DIFFERENTIATION OF APPENDICITIS AND THE DYSENTERIES.

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THE clinical differentiation between appendicitis and the dysenteries has achieved added importance by the presence of our troops in countries where the dysenteries are endemic. A study of the cases reported in this paper shows that the subject under discussion may be divided into the following sections: (i) appendicitis with symptoms of bacillary dysentery; (ii) bacillary dysentery simulating appendicitis; (iii) bacillary dysentery causing appendicitis; (iv) amœbic dysentery simulating appendicitis; (v) schistosomiasis of the appendix.

Appendicitis with Symptoms of Bacillary Dysentery.

The first section comprises Cases I to IV. In the tropics one is impressed with the number of cases of acute appendicitis in which diarrhœa is a prominent feature. The disorder may mimic bacillary dysentery, which in many cases commences only with abdominal pain and the infrequent passage of diarrhœal stools without blood or mucus. Difficulties in differentiation are especially seen when the inflamed appendix is in the retroileal position (Case I), the retrocaecal position (Cases II and III) or the pelvic position (Case IV). All these cases had one symptom in common with bacillary dysentery, namely, diarrhœa. As

they all occurred in endemic dysentery areas, this assumed an aspect of importance unusual in more temperate zones. Should such cases occur during a dysentery epidemic, the passage of one diarrhœal stool alone may be sufficient to confuse the diagnosis.

The important positive finding leading to the diagnosis of acute appendicitis with diarrhœa is the constant and increasing intensity of the abdominal pain and tenderness, ultimately localized in the right iliac fossa. This tenderness persists and later may be associated with muscular rigidity. If the appendix is retrocaecal, the pain and tenderness may be localized in the right loin (Case II); this never occurs in bacillary dysentery.

Should the diagnosis of appendicitis be delayed, abscess formation may occur and the finding of a mass in the abdomen (Case III) or pelvis (Case IV) then leaves no doubt as to the diagnosis. That in these cases the condition went so far without arousing the suspicion of appendicitis illustrates the confusion in diagnosis that the presence of diarrhœa may cause, and the importance of diarrhœa in the clinical picture.

White cell counts cannot be relied upon in the differential diagnosis. A neutrophile leucocytosis, especially a rising count, as in Case I, points to appendicitis. In bacillary dysentery usually the white cell count is normal; but this is also common in appendicitis even when complicated by abscess (Case III).

The temperature does not help, as it may or may not be raised in either disease. In the tropics many patients suffering from acute appendicitis have a much higher temperature—even up to 104° F.—than we are accustomed to find in more temperate zones. Such a high temperature, together with diarrhœa, may confuse the examiner.

Blood or pus is rarely found in the diarrhœal stool of appendicitis, and the presence of either will point to dysentery. Mucus may be present in the stool of a patient with a pelvic abscess, but the rectal findings will serve to diagnose this condition. The absence of blood or pus does not exclude dysentery, however, as many dysentery patients never pass blood or pus in the stools, especially if sulphaguanidine is given early in the treatment.

Tenesmus may be present in pelvic appendicitis and abscess; but again, rectal examination will differentiate this condition from dysentery. Tenesmus is usually absent in early or mild bacillary dysentery.

The above findings and the absence of *Bacterium dysenteriæ* from cultures of the stool (if time permits) will serve to differentiate appendicitis from the dysenteries.

If the correct diagnosis has been delayed and the patient is treated as suffering from dysentery, sulphaguanidine will be observed to have no effect on the course of the illness (Cases I, III and IV). This observation may be regarded to some extent as a diagnostic aid, but usually it should not be necessary.

Bacillary Dysentery Simulating Appendicitis.

The second section covers Cases V to VIII. Bacillary dysentery may simulate appendicitis in different ways, depending on the phase of the disease. The manifestations of acute bacillary dysentery are so protean that appendicitis may be diagnosed if one is not constantly on the alert.

In some cases of acute bacillary dysentery there may be a longer interval than usual between the onset of pain and the onset of bowel symptoms. It is in this interval that mistakes are apt to occur, as in Case V, in which the pain and tenderness were so pronounced that the appendix was removed. After appendicectomy diarrhœa occurred with the passage of blood and mucus, and *Bacterium flexneri* was isolated from the stools.

It is difficult to see how operation can always be avoided in such cases, which may clinically appear to be too acute to allow of delay for further observation or cultural examination of the stools. Sigmoidoscopy gives no help in the differential diagnosis, as in early dysentery the mucosa of the lower bowel appears normal.

Acute fulminating dysentery (Case VI) may simulate acute appendicitis. In these rare cases the organisms invade the bowel wall and may cause signs of an acute abdominal catastrophe. If the caecum and ascending colon are involved acute appendicitis may be diagnosed. Fortunately in these cases the dysenteric symptoms and stool cultures furnish the true diagnosis, so that there is no reason for operation unless the rare perforation of bowel occurs or a pericolic abscess forms. Bacillary dysentery with the complication of bowel wall invasion is associated with a neutrophile leucocytosis (Case VI). It is interesting to observe in this case that sulphaguanidine was effective only until the organisms penetrated the bowel walls. The systemic administration of sulphadiazine was then effective.

In its chronic recurrent forms bacillary dysentery may simulate recurrent appendiceal colic. A patient may have a short attack of dysentery, so mild that he neither reports for treatment nor afterwards remembers its occurrence. Nevertheless, at varying intervals afterwards, several attacks may occur, especially after dietetic indiscretions, and he may have a day's illness with abdominal cramps and diarrhœa, possibly with the passage of blood and mucus. Sometimes this attack may be associated with constipation and not with diarrhœa, and the pain may be localized to the right iliac fossa, where tenderness is often found. Appendiceal colic may be diagnosed if careful attention is not paid to the history, or if the organism cannot at first be isolated from the stools in culture, as in Case VII, in which an appendicectomy was performed as the result of an incorrect diagnosis. The full history of this patient was not elicited until after operation, when doubt as to the diagnosis was entertained. Like many soldiers, he believed that mild diarrhœal attacks were a normal feature of the tropics, and he did not think them worth mentioning. Consequently leading questions as to the occurrence of diarrhœa may be necessary, and the suspicion of a previous bowel infection will keep one on the alert and delay operation whilst the stools are being bacteriologically examined. Repeated attempts may be necessary in these cases before *Bacterium dysenteriæ* is isolated from the stools. Should the appendix have been removed before the initial attack of dysentery occurred, then there is of course no doubt as to the diagnosis.

Bacillary dysentery may be followed by the "irritable colon" syndrome, which may simulate recurrent appendiceal colic. After an attack of proven bacillary dysentery a patient may suffer from recurrent attacks of abdominal colic of varying intensity for some months. These attacks are especially apt to occur after dietetic indiscretions or after exposure to cold. They are not usually accompanied by diarrhœa and the dysentery organism cannot be isolated from the stool. Case VIII illustrates these points and shows that the differentiation rests chiefly upon the history.

Bacillary Dysentery Causing Appendicitis.

The third sections covers Cases IX and X. An attack of bacillary dysentery may help to cause acute appendicitis. It may affect the mucosa of the appendix, either by spread of œdema from the affected caecum or by actual infection of the appendiceal mucosa with *Bacterium dysenteriæ*. This in itself will give rise to no special symptoms, but should a fæcolith be present in the appendix, this is aided by the swollen mucosa to cause an obstruction of the appendiceal lumen leading to acute obstructive appendicitis. In both types the resultant appendicitis is due to the mechanical effects of the obstruction and consequent secondary infection, and is not due to any specific effect of the dysenteric organisms. Consequently patients who during the course of dysentery suffer from localized pain in the right iliac fossa must be carefully observed to see whether appendicitis is developing.

Case IX illustrates acute obstructive appendicitis due to the spread of mucosal œdema from the caecum, whereas in Case X the dysenteric infection involved the appendix only, the rest of the bowel being normal. Strangely enough, this was caused by *Bacterium shigæ*.

Amœbic Dysentery Simulating Appendicitis.

The fourth section comprises Cases XI to XIII. Although amœbic dysentery accounts for a relatively small proportion of cases in Australia and the adjoining islands, cases con-

stantly occur, especially among troops who have been in the Middle East or among refugees from Japanese-occupied islands. Amœbic dysentery is also endemic in certain parts of Australia — for instance, the Kalgoorlie district of Western Australia. Thus one may meet any of the syndromes of amœbic dysentery which may simulate appendicitis. In these cases mistaken operation is much more serious than in the bacillary infections, and a high mortality may ensue, especially if anything in the nature of a radical operation is attempted.

Amœbiasis must be suspected in patients with abdominal symptoms who have ever lived or are living in countries where it is endemic. The history of a previous attack of amœbic dysentery or dysentery of undetermined origin, no matter how long previously, is important, especially if the illness is associated with chronic ill health, loss of weight or anæmia. The finding of a tender, thickened caecum or a tender, enlarged liver points to amœbic infection. Fæcal investigation may reveal the trophozoite form of *Entamœba histolytica* or the cysts alone in the more chronic forms. Sigmoidoscopy may reveal areas of unsuspected colonic ulceration, scrapings from which may be found to contain the amœbæ. A barium enema examination may reveal chronic colitis. If, in spite of negative findings, one still suspects amœbiasis, and if amœbiasis is in fact present, the exhibition of emetine will cure the symptoms and so confirm the diagnosis.

Acute or fulminating amœbic dysentery may simulate an acute appendiceal abscess, though it is rarely that acute appendicitis will be diagnosed, because the dysenteric symptoms overshadow the rest of the clinical picture. The finding of amœbæ in the stools and the response to emetine therapy leave no doubt as to the correct diagnosis. Nevertheless, diagnostic pitfalls may occur, as in Case XI, in which insufficient attention was paid to the previous history, so that amœbiasis was not suspected before operation.

Appendicitis is more apt to be diagnosed in the more chronic forms of bowel amœbiasis unless careful investigations are first performed. Case XII shows the value of a carefully taken history, which revealed that the patient had suffered from diarrhœa in India years previously. This, in addition to the clinical findings of chronic ill health, created the suspicion of amœbiasis, the presence of which was confirmed by pathological investigation.

Amœbic hepatitis itself in its early stages may simulate appendicitis, as is seen in Case XIII. Here the presenting symptoms and signs were referred to the abdomen and right iliac fossa; but further examination revealed a tender, enlarged liver and a raised diaphragm, which showed the correct diagnosis.

In the same way as an "irritable colon" may follow an attack of bacillary dysentery, so it may follow an attack of amœbic dysentery. In the latter instance the previous history and the finding of amœbic cysts in the usually normal-looking fæces will furnish the diagnosis, which will be confirmed by the response to emetine therapy.

A patient with amœbiasis may have a pericaecal abscess from an insidious perforation of the caecum. This may simulate a quiet appendiceal abscess, and it can be differentiated only by the history and the suspicion of amœbiasis or the finding of evidence of amœbic infestation in the stools. These abscesses certainly need operation; but the patient also needs emetine. Consequently in the tropics the pus of all abscesses in the right iliac fossa must be carefully investigated for amœbic infection. Such cases may be encountered among escaped prisoners of war and refugees who have not received medical attention for weeks or months, so that a gross form of the disease may be found.

Schistosomiasis of the Appendix.

The fourth section is exemplified by Case XIV. The influx of refugees from the Far East and of troops from Egypt occasionally brings to notice cases of schistosomiasis of the appendix.

Schistosomal infestation of bowel usually causes a dysentery clinically indistinguishable from that due to other organisms. It is diagnosed by the presence of the schistosome ova in the bloody mucus of the stools or in the ulcers of the bowel. However, bilharzial ova deposited in the appendix may cause symptoms of subacute appendicitis, and the appendix may even be palpable, as the organ is thickened and infiltrated. This condition may be complicated by the presence of secondary pyogenic invaders, as in Case XIV, in which the ova of *Schistosoma japonicum* were found. The swelling of the appendiceal mucosa caused by the presence of these ova together with a fæcolith caused acute obstructive appendicitis.

In these cases it is obvious that exact diagnosis is difficult unless one obtains a prior history of dysentery or schistosomal infestation. In infestation by *Schistosoma japonicum* enlargement of the liver or spleen or eosinophilia may be found, though none of these signs was present in Case XIV. The only sure sign is the finding of schistosomal ova in the stools, and again these were not found in this case. However, the imporptant thing is to diagnose the acute appendicitis, as this is due to the presence of the secondary pyogenic invaders superimposed on the original bilharzial infestation of the appendix, and urgent operation is necessary. The later finding of bilharzial ova in the appendix is also important, because it shows the presence of the worms in the portal venous system. Antimony is necessary for their destruction.

Reports of Cases.

Appendicitis with the Symptoms of Bacillary Dysentery.

CASE I.—The patient, a soldier, aged twenty years, had never previously had any abdominal symptoms or diarrhœa. His illness commenced with mild generalized abdominal colic, most pronounced in the epigastrium, causing him to vomit once. Half an hour later he passed a loose stool and the pain was eased. The pain recurred an hour later and a similar diarrhœal stool was passed.

On examination the patient looked ill and had a furred tongue. His temperature was 99° F. and his pulse rate was 100 per minute. Slight generalized abdominal tenderness was present, but no rigidity. A leucocyte count showed the white cells to number 8,000 per cubic millimetre, 75% being neutrophile cells. The fæces were brown and liquid and contained no blood or mucus. No amœbæ were detected in them, and no *Bacterium dysenteriæ* was isolated from them.

In the meantime a diagnosis of bacillary dysentery was made and sulphaguanidine was administered. The diarrhœa continued, and twenty-four hours later the pain became much worse; it was localized in the right iliac fossa. His temperature was now 100° F. and his pulse rate was 110 per minute. Slight generalized distension of the abdomen was present, and there was tenderness in the right iliac fossa. Rectal examination revealed tenderness high up on the right side. A leucocyte count now showed the white cells to number 12,500 per cubic millimetre, 80% being neutrophile cells. A diagnosis of acute appendicitis was made and operation disclosed a gangrenous appendix in the retroileal position.

CASE II.—The patient was a soldier, aged twenty-eight years, serving in an endemic dysentery area. For the past five years he had suffered from vague epigastric discomfort after meals. Two days prior to his admission to hospital he had severe generalized abdominal pain, which commenced soon after a meal and was followed by an attack of diarrhœa without the passage of blood or mucus. The pain subsided, but recurred two hours later, and was again followed by diarrhœa. During the next forty-eight hours the pain became worse and was localized to the right flank and loin. He had four loose motions on the first day and six on the second, all without the passage of blood or mucus.

On examination the patient looked ill and had a furred tongue. His temperature was 99° F. and his pulse rate was 100 per minute. Slight generalized abdominal distension and tenderness were present, especially over the caecum, which was a little distended but not thickend. No mass was palpable in the right iliac fossa. Tenderness was present in the right loin and pain was elicited by the psoas test. Rectal examination revealed no abnormality. A leucocyte count showed the white cells to number 13,500 per cubic millimetre, 80% being neutrophile cells. A diagnosis of retrocaecal appendicitis was made and a gangrenous retrocaecal appendix was removed.

CASE III.—The patient, a soldier, aged thirty years, had had an attack of acute bacillary dysentery in the Middle East some three years previously. He was then quite well until four days prior to his admission to hospital, when his

present illness commenced with vague generalized abdominal pain causing him to feel nauseated. At that time he was constipated. Forty-eight hours later the pain was still generalized and colicky in nature, but a little more pronounced on the right side. Tenderness was present all over the abdomen.

He now commenced frequently to pass diarrhœal stools without blood or mucus. Bacillary dysentery was diagnosed and sulphaguanidine therapy was instituted. The organism was not recovered, however, in cultures from the stools, and on the fourth day the pain became more pronounced in the right iliac fossa and a mass was palpated there. The leucocytes numbered 8,000 per cubic millimetre, 70% being neutrophile cells. Operation was performed and a retrocaecal abscess was opened. It was caused by acute obstructive appendicitis.

CASE IV.—The patient, a soldier, aged twenty years, had been healthy until three days prior to his admission to hospital, when he suffered from severe periumbilical and hypogastric pain. He vomited and noticed a feeling of fullness in the rectum, but he could not pass a stool. The pain was constant for twenty-four hours and then became worse. Eight hours later he had attacks of diarrhœa with tenesmus. The stools were brown and fluid and streaked with mucus, but they contained no blood or pus. His temperature was 99° F. and his pulse rate was 110 per minute. Some tenderness was present over the abdomen, especially in the hypogastrium. Rectal examination disclosed tenderness anteriorly. He was treated as suffering from bacillary dysentery, full sulphaguanidine therapy being instituted.

Sixty hours after the commencement of his illness he felt much worse and had frequency of micturition with scalding. The hypogastric pain was severe and constant, and he had a constant feeling of rectal fullness and tenesmus, with the frequent passage of small slimy liquid motions. His temperature was 100° F., his pulse rate was 110 per minute, and his tongue was furred. His abdomen was a little distended, and generalized tenderness was present, especially in the hypogastrium, where there was a little rigidity. Rectal examination revealed a large, tender, indefinite mass to the right of and in front of the rectum.

Operation disclosed a large pelvic abscess, full of foul-smelling pus, due to a ruptured gangrenous pelvic appendix.

Bacillary Dysentery Simulating Appendicitis.

CASE V.—The patient, a soldier, aged twenty-five years, was admitted to hospital during an epidemic of Flexner dysentery. He had always been healthy until eight hours previously, when he was seized with severe generalized abdominal pain, which made him vomit once. The pain became worse, and though it was still generalized, he stated that it was more pronounced in the right iliac fossa. There was no tenesmus or diarrhœa.

On examination the patient looked ill, his temperature was 99° F. and his pulse rate was 100 per minute. The tongue was furred. Generalized abdominal tenderness was present, and was more severe in the right iliac fossa. Slight generalized rigidity was noted. Rectal examination and sigmoidoscopic examination revealed no abnormalities. A leucocyte count gave normal results.

A diagnosis of acute appendicitis was made and the abdomen was explored. Some clear free peritoneal fluid was found. The terminal portions of the ileum, the caecum, and the ascending colon were thickened with œdema and reddened with inflammation. There was no fibrin on the serosal coat of the bowel. The appendix was similarly involved. It was obvious, therefore, that the patient was suffering from bacillary dysentery in which, for some reason, the bowel symptoms were delayed. This was proved later by the passage of blood and mucus in the stools, from which *Bacterium flexneri* was isolated.

CASE VI.—A soldier, aged thirty years, was admitted to hospital during the course of an epidemic of Flexner dysentery, with the history that two days previously he, in common with many others of his unit, had been seized with generalized colicky abdominal pain and vomiting, followed some hours later by tenesmus and the hourly passage of stools with the typical bacillary exudate of blood and pus. *Bacterium flexneri* was isolated from the stool.

On his admission to hospital his temperature was 100° F., his pulse rate was 110 per minute and his tongue was furred. Generalized abdominal tenderness was present, especially along the course of the transverse and descending colon. The caecum was a little tender. There was no abdominal rigidity. A rectal examination revealed no abnormality.

Sulphaguanidine therapy was instituted and his condition quickly improved, so that on the third day his temperature was normal, the pain and tenderness had diminished, he had no tenesmus and his stools were passed much less frequently, though they still contained blood and pus. The pain then became worse and was generalized all over the abdomen, being most severe over the caecum. His temperature rose again to 100° F. and swung between this and 102° F. in the next few days. He vomited continuously, so that an indwelling Ryle's tube had to be inserted. The whole abdomen was tender and rigid, especially on the right side, and though his bowel actions were not so frequent as before, he still passed small motions containing blood and pus. He was treated with the intravenous administration of fluid, including pooled serum, and the intravenous administration of sulphadiazine, sulphaguanidine therapy having been suspended. During the next two days his condition remained the same as before, save that rigidity became more pronounced over the descending colon and slightly less over the caecal area. Repeated white cell counts gave results always in the region of 10,000 white cells per cubic millimetre, 85% being neutrophile cells. A diagnosis was made of pericolitis and perityphlitis with a probable large exudation of fluid in the abdominal cavity. His condition did not deteriorate, though he was very ill, so that abdominal exploration was not performed. After forty-eight hours he gradually improved; first the rigidity and later the tenderness retrogressed. His temperature dropped to normal, vomiting ceased and the motions gradually became normal.

CASE VII.—Nine months previously the patient, aged twenty-three years, had a mild attack of abdominal cramps, with the passage every three or four hours of diarrhœal stools not containing blood or mucus; other members of his unit were similarly affected. He did not "report sick" and was well in two days. After that he occasionally had attacks of mild abdominal cramps associated with diarrhœa. During one attack he noticed a little blood in the stool. These attacks of pain increased in severity, and in the last attack the pain stopped in the right iliac fossa. This time he was constipated.

On examination the patient looked well. His temperature and pulse rate were normal and his tongue was clean. Tenderness was present over the caecum, which was a little thickened. Rectal examination revealed no abnormality. The fæces were normal in appearance, and cultural examination revealed no dysenteric organisms. Sigmoidoscopy and a barium enema examination produced normal findings.

A diagnosis was made of a recurrent appendiceal colic and the abdomen was explored. The bowel and the appendix were normal in appearance, though the latter had two small fæcoliths in its lumen. Appendicectomy was performed. He was then well for one month, when the attacks of abdominal pain and diarrhœa recurred. Cultural examination of the stools was again made and after several attempts *Bacterium flexneri* was isolated. This finding showed that all his symptoms were due to a grumbling focus of *Bacterium flexneri* somewhere in the bowel.

CASE VIII.—The patient, a soldier, aged thirty years, had had an attack of bacillary dysentery in the Middle East one year previously. On returning to Australia he noticed that whenever there was a cool change in the weather he was apt to suffer from attacks of abdominal cramps, lasting from several minutes to hours, which were often referred to the right iliac fossa.

On examination during an attack the patient was seen to be a healthy man with a normal temperature and pulse rate. Tenderness was pronounced in the right iliac fossa and over the course of the descending colon. The caecum and colon were not thickened, and no abdominal rigidity was present. The stools were normal in appearance, and investigation revealed no dysentery infection. Sigmoidoscopy and a barium enema examination revealed no abnormality. The attacks gradually lessened in intensity until they disappeared about fifteen months after the onset of the illness.

Bacillary Dysentery Causing Appendicitis.

CASE IX.—The patient, a soldier, aged thirty years, had a classical attack of acute bacillary dysentery due to *Bacterium flexneri*. He had generalized abdominal pain, tenesmus and the frequent passage of stools with "bacillary exudate". He was treated with sulphaguanidine and his general condition improved, but he still had occasional cramps with the passage of dysenteric stools, up to one month after the commencement of his illness. This pain was gradually becoming localized in the right iliac fossa, where constant tenderness was present. The caecum was always thickened and tender. Sigmoidoscopy revealed inflammation of the rectal mucosa and the lower pelvic portion of the colon, but there was no ulceration. Culture of the stools still yielded *Bacterium flexneri*. Repeated leucocyte counts gave normal results.

Sulphaguanidine was having no further effect on the patient, and at the end of a fortnight the pain in the right iliac fossa suddenly became worse and he vomited. Examination disclosed that his tongue was furred, his temperature was 101° F. and his pulse rate was 90 per minute. Tenderness and rigidity were present in the right iliac fossa. The caecum was thickened, but not so the rest of the colon. The leucocyte count was again normal.

As the symptoms and signs were so localized, it was decided that the patient was suffering from appendicitis, probably due to the dysentery.

Operation was performed and some clear peritoneal fluid was found. The caecum was thickened and œdematous, but the rest of the bowel was normal. The appendix was pelvic in position and all coats were acutely inflamed. Mucosal swelling was observed, but no ulceration was present. There was one large fæcolith, which, with the swollen mucosa, had caused a complete obstruction. The lumen was full of foul pus, from which *Bacterium coli* was isolated. No bacillary organisms were present in the walls of the appendix.

CASE X.—The patient, a male, aged twenty-nine years, complained of severe abdominal pain of forty-eight hours' duration. This pain was first generalized all over the abdomen, being worse in the epigastrium. Eighteen hours later it radiated to the right iliac fossa, where it became localized. It grew increasingly severe and a diagnosis of acute appendicitis was made; but he then passed one diarrhœal stool containing blood and mucus, twenty-four hours after the commencement of his illness. At that time bacteriological facilities were unavailable, and his condition was diagnosed as "clinical dysentery". From then on the pain became worse, but he passed no further motions.

On his admission to hospital he was seen to be very ill. His tongue was furred, his temperature was 102° F. and his pulse rate was 110 per minute. Tenderness and rigidity were present in the right iliac fossa. Rectal examination disclosed tenderness high on the right side of the rectum. The leucocytes numbered 11,000 per cubic millimetre, 85% being neutrophile cells. A diagnosis of acute appendicitis was made, in spite of the passage of a stool suggesting dysenteric infection.

Operation disclosed a little clear peritoneal fluid. The appendix was retrocaecal in position, four inches long, red, swollen and œdematous, and covered with plaques of fibrin. Two fæcoliths were obstructing the appendix at its base, and turbid fluid was present in its lumen. The mucosa was œdematous and ulcerated. The rest of the bowel appeared normal.

The appendix was removed and microscopic examination revealed œdema and polymorphonuclear infiltration of all layers. Culture of the contents yielded *Bacterium shigæ*.

Convalescence was uneventful, the temperature remaining at 102° F. for two days and then falling rapidly to normal. There was no diarrhœa, and on the fourth day the patient passed a normal stool; he continued to do so each day afterwards. At no time was *Bacterium shigæ* isolated from the stool.

Amœbic Dysentery Simulating Appendicitis.

CASE XI.—The patient, a sailor, aged thirty-five years, had lived for some years in the Far East. He stated that he had had numerous mild attacks of diarrhœa, at times with the passage of blood and mucus, in the ten years prior to being examined, and had lost one stone in weight in the previous six months. For the past fourteen days he had felt a little ill and had had vague abdominal pains. He was constipated. Eight hours prior to examination he had an attack of severe generalized abdominal pain, which radiated to and became localized in the right iliac fossa and made him vomit.

On examination the patient looked thin and ill; he had a somewhat earthy complexion and a furred tongue. His temperature was 100° F. and his pulse rate was 110 per minute. Great tenderness and rigidity were present in the right iliac fossa, and a mass seemed to be present there. The liver and spleen were not palpable. Rectal examination revealed no abnormality.

A diagnosis of acute appendiceal abscess was made and operation was performed. Much clear free peritoneal fluid was present. The terminal portion of the ileum, the ascending colon, the caecum and the appendix were reddened with inflammation and thick with œdema. There were no signs of perforation or abscess formation. The significance of the previous history was then appreciated, and it was decided that the patient was suffering from amœbiasis of the colon. The abdomen was closed without further interference.

The patient was then transferred to a hospital with better pathological facilities. A full blood count revealed that the erythrocytes numbered 4,000,000 per cubic millimetre and the hæmoglobin value was 75%. The leucocytes numbered 12,500 per cubic millimetre, 85% being neutrophile cells. Examination of the stools revealed some mucus but no blood; the trophozoite and cystic forms of *Entamœba histolytica* were readily demonstrated in them.

CASE XII.—The patient, a woman, aged forty years, had lived in India for twenty years. In her first year there she had a short attack of dysentery in which she passed blood and mucus. She was well for the next fifteen years, but during her last five years in India she suffered from chronic ill health with generalized malaise, poor appetite, loss of weight and neuralgia of indefinite localization. She returned to England and for five years noticed vague cramp-like abdominal pain, which was often localized in the right iliac fossa and was associated with tenderness. This pain became so persistent that she was referred to hospital with the diagnosis of recurrent appendiceal colic.

On examination the patient was seen to be a thin woman with an earthy complexion. She looked ill and her tongue was furred. Her temperature was 99° F. and was shown to vary from 99° F. to 101° F. Her pulse rate was 110 per minute. Tenderness was present in the right iliac fossa and the caecum was thickened. There was no enlargement of the spleen or liver. A rectal examination revealed no abnormality. A blood count revealed a secondary anæmia; the erythrocytes numbered 3,500,000 per cubic millimetre and the hæmoglobin value was 60%. The leucocytes numbered 10,000 per cubic millimetre, 75% being neutrophile cells. Sigmoidoscopy and a barium enema examination revealed no abnormality. After several examinations the fæces, which were of normal appearance and consistency, were found to contain the cysts of *Entamœba histolytica*.

CASE XIII.—This patient escaped from a Japanese-occupied island in the south-west Pacific area. He had evaded capture by living in the jungle for six months. He lived on raw roots and vegetables, and had to drink water contaminated by natives. He had several attacks of diarrhœa without blood or mucus in the stools and lost four stone in weight. He was treated for severe nutritional deficiency and his condition improved. He then suffered from severe attacks of abdominal pain, sometimes radiating to the right iliac fossa and sometimes to the right hypochondrium, but more often to the former.

On examination the patient was seen to be very ill. He was wasted and looked anæmic. His tongue was furred and his temperature was 100° F., his pulse rate was 100 per minute and his respirations numbered 20 per minute. The conjunctiva had a slight icteric tinge. Severe nutritional œdema of the legs and back was present. Tenderness and a little rigidity were present in the right iliac fossa. The caecum was enlarged and thickened. Tenderness was also present in the right hypochondrium, and the lower border of the liver was palpable and tender. There was some slight dulness to percussion at the base of the right lung, with diminished air entry. Rectal examination and sigmoidoscopy revealed no abnormality. A full blood count revealed that the erythrocytes numbered 2,500,000 per cubic millimetre and the hæmoglobin value was 40%. The leucocytes numbered 15,000 per cubic millimetre, 80% being neutrophile cells. The fæces appeared normal, but the cysts of *Entamœba histolytica* were found in them. A radiograph showed that the right dome of the diaphragm was raised higher than normal and it did not move when a fluoroscopic examination was made. The diagnosis was thus a subphrenic amœbic abscess; this was later confirmed by aspiration of the typical pus. Emetine was given, and this completely and rapidly cleared up the pain and tenderness in the right iliac fossa.

Schistosomiasis of the Appendix.

CASE XIV.—The patient, a Chinese sailor from the Far East, had no previous history of diarrhœa or dysentery. He was suddenly seized with severe abdominal pain, commencing round the umbilicus and radiating to the right iliac fossa, and associated with vomiting and constipation. The pain became worse, and when he was examined eight hours after its commencement his temperature was 100° F., his pulse rate was 90 per minute, and his tongue was furred. Tenderness and rigidity were present in the right iliac fossa. There was no enlargement of the liver or spleen. Rectal examination revealed tenderness high up on the right side of the rectum.

A diagnosis of acute appendicitis was made. Operation disclosed some clear free peritoneal fluid. The appendix was acutely inflamed, swollen and covered with fibrinous plaques. It was friable, but had not ruptured. The caecum adjacent to its base was thickened and œdematous. On removal, the appendix was found to contain one fæcolith. The mucosa was swollen and ulcerated, and there was pus in the lumen

from which *Bacterium coli* was later isolated. Histological examination of the appendix revealed the ova of *Schistosoma japonicum* scattered throughout all coats. They were associated with a polymorphonuclear infiltration due to secondary pyogenic invaders.

During convalescence frequent stool examinations revealed no ova. A white cell count gave normal results, and there was no eosinophilia as is usual in this disease. Cystoscopy and sigmoidoscopy revealed no abnormality.

Discussion.

Appendicitis and the dysenteries may be differentiated by attention to the following important points.

1. An inquiry should be made as to whether the patient has lived in an endemic dysentery area.

2. A previous history of even a clinically negligible attack of dysentery or, better still, of a proven attack of bacillary or amœbic dysentery, is significant.

3. A history of chronic ill health, of loss of appetite and of weight, and of anæmia is of importance.

4. The patient should be carefully questioned as to the bowel function in the present illness. Many patients present themselves with abdominal pain and tenderness, often referred to the right iliac fossa, and it is only on direct questioning that they admit to diarrhœa as well, the significance of this symptom not having occurred to them.

5. In the abdominal examination particular attention is paid to the location of pain, to the presence of tenderness or rigidity, to any tenderness or thickening of the caecum or colon, and to the presence or absence of abdominal masses, especially in the right iliac fossa. The liver and spleen are examined for enlargement, displacement or tenderness. The chest is examined, especially the base of the right lung, for any signs of pressure by an enlarged liver or subdiaphragmatic abscess. Rectal and sigmoidoscopic examinations may disclose unsuspected mucosal involvement of the lower bowel.

6. Pathological investigations are necessary. A full blood count will demonstrate anæmia or leucocytosis if either is present. A differential leucocyte count may reveal neutrophilia or eosinophilia. Enough has already been stated to show that white cell counts are unreliable and must not be depended upon for diagnosis. In malarial areas all patients are as a routine measure examined for this infection. Whenever possible the fæces must be examined for the presence of blood, pus or mucus and for the trophozoite and cystic forms of *Entamœba histolytica*. Cultural examinations are made to detect *Bacterium dysenteriæ*. If dysentery organisms cannot be found in cultures from the fæces, examination of scrapings from inflamed bowel mucosa or ulcers, obtained by sigmoidoscopy, may disclose their presence. Any tissue or pus removed at operation must be examined histologically and bacteriologically.

7. Radiographic examination, especially of the bowel and the region of the liver, is necessary.

8. The diagnostic use of emetine is helpful.

Malaria.

With regard to the question of malaria, it is now believed that blood or mucus in the stools of a patient suffering from subtertian malaria is due to a coincidental dysenteric infection, and this is a common occurrence where both these diseases are endemic. It may therefore be seen that appendicitis with diarrhœa may simulate bacillary dysentery, or *vice versa*, during the course of a superimposed malarial infection, the symptoms of which further complicate the clinical picture. The presence of malaria having been confirmed by blood film examination, the same methods of differentiating appendicitis and dysentery are used.

Conclusion.

In conclusion, the importance of carefully taken histories and of careful physical and pathological examinations is emphasized, in order that erors in diagnosis may be avoided.

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BLOOD GROUPS IN THE TERRITORY OF PAPUA.

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FROM an analysis of blood grouping data alone it may be assumed that the Australian aborigines of the Cape York Peninsula do not constitute a pure race, for they show evidence of comparatively recent admixture with another race possessing the blood factor B. It is on record (Flinders, 1814) that many fishing vessels from Macassar regularly visited the waters around Arnhem Land as early as the year 1802 and engaged in trepang fishing; but the Malayan crews did not interfere with the Australian aborigines, who were not particularly friendly. This is substantiated by the fact that although a high percentage of group B blood is found in the Malays, this group was absent from blood samples collected 140 years later from Australian aborigines living in the Northern Territory and on the north-west coast of Western Australia (Gay, 1942; Wilson, Graydon, Simmons and Bryce, 1944).

In a previous paper (Simmons, Graydon and Hamilton, 1944) it was suggested that the frequency of the sub-group A_2 was probably low in the particular race or races responsible for the presence of the B factor in a limited number of aborigines in the Cape York area. It seems logical to assume that this race came from New Guinea, which is separated from Cape York by the island-studded Torres Strait.

Previous surveys (Heydon and Murphy, 1923; Bos, 1932; Bijlmer, 1935) have shown that the percentage of the B factor is relatively high in New Guinea natives; but no data have been published regarding the sub-groups of A, the M, N types or the Rh factor. For these reasons the information to be gained by testing blood samples from Papuans assembled as native carriers seemed to be well worth seeking. We are grateful to Lieutenant-Colonel R. MacDonald and Lieutenant-Colonel E. Thomson for making the necessary arrangements for this survey, and to Lieutenant-Colonel Mack and Major Ferris, who kindly undertook the collection of the samples and the compiling of individual details for our records.

Stirling (1943) makes the following statements regarding the native peoples of New Guinea:

> In a broad sense the New Guinea natives can be divided into three groups: the Negritos, the mountain tribes of the interior; the Melanesians of the north and east coast; and the Papuan of the interior lowlands and western coast. . . . The Papuan racial stock evidently came into New Guinea at an early date following the Negrito migration from the Indonesian area. They spread over most of the island and may be considered the most characteristic stock making up its present population. . . . They seem to be related in part to the natives of Australia. They speak a distinct group of dialects unrelated to the other languages of Oceania excepting those of northern Australia. . . . Undoubtedly a small element of Australian peoples reached New Guinea at an early date. The crossing by way of the Torres Strait islands would be a simple matter, and is surprising that Australian influences are not even more pronounced. As has been pointed out there are linguistic connections between Papuan dialects and those of northern Australia. Australian physical resemblances can be seen in some of the southern Papuan tribes and among the Negrito groups of the Nassau Mountains. In this latter region particularly are many cultural practices which are reminiscent of the Australian tribes.

Material and Methods.

The blood samples were obtained from adult full-blooded Papuans serving as carriers to the Australian Military Forces. In all we examined 200 samples from unrelated natives, who originated in 177 separate villages, mostly situated in coastal and river districts of the territory of Papua. A group of 24 natives from the Kokoda district in the Owen Stanley Range is also included. No attempt was made to classify the individuals into their racial groups by physical examination; but the series is thought

to be fairly representative of the inhabitants of the south-eastern coastal districts of New Guinea—an area not covered in any previously reported blood group survey. Our collaborators were aware of the fact that any individual showing evidence of white admixture should be excluded from the series.

Two drops of blood were collected into rubber-stoppered phials containing one cubic centimetre of sterile glucose-citrate solution of Rous and Turner, to which had been added "Merthiolate" to a strength of 0·001%. The phials were immediately transferred to "Thermos" flasks, which were packed with ice and returned to Melbourne by air through the courtesy of the Royal Australian Air Force. As controls, blood samples taken from 20 members of the Australian Imperial Force serving in New Guinea were forwarded with the native samples in the same flasks. On receipt in Melbourne all of the samples appeared to be satisfactory, there being no evidence of hæmolysis in any phial. The samples were tested within seventy-two hours of collection. Human serum of high titre was selected for the determination of the groups; for the sub-groups and the M, N types we used the same serum and technique as were used by Simmons, Bryce, Graydon and Wilson (1941). Tests for the Rh factor were made by the slide technique of Simmons, Graydon, Jakobowicz and Bryce (1943), with a potent human serum, "Mrs. C.", now known to be a standard anti-Rh_0 serum. Full controls were used throughout the actual tests, and all samples classified as of group AB were tested against group AB serum to detect the possible presence of pan-agglutinable cells.

Results and Discussion.

The results of this survey are shown in Table I, figures being given separately for the administrative districts in which the villages where the natives were born were situated (see Figure I). These districts are arranged in order from west to east, with the exception of Kokoda, situated in the central mountain range, and Tufi, on the north-east coast.

The usual statistical tests give $D/\sigma = 1·2$ for the A, B, O results, and $D/\sigma = 2·7$ for the M, N figures. The latter value is unexpectedly high, and as D is negative, it suggests that the group is not genetically homogeneous (Graydon, 1944). Perusal of the figures for the separate districts reveals evidence supporting this theory. In the combined results for the Daru and Kikori districts, situated in the river delta lowlands on the western side of the Gulf of Papua, the frequency of n was 0·95, compared with 0·67 for combined results for the more easterly areas along the south coast (Table II). This difference would account for the above-mentioned high D/σ value. It is of interest to recall that Birdsell and Boyd (1940) found an area of high n frequency in the Laverton and Warburton Ranges districts of Western Australia, which they attributed to the tendency of a gene, initially of low frequency, to be lost, in a small group, during a long period of isolation.

The frequencies of the A, B, O groups in the Daru-Kikori area differ from those of the other south coast districts, but to a lesser extent than do the M, N type frequencies.

TABLE II.

Comparison between the Daru-Kikori Area and the Other South Coast Districts.

Observation.	Daru-Kikori Area. (77 Subjects.)	Other South Coast Districts. (91 Subjects.)
Percentage of blood groups:		
O	38	48
A	26	32
B	27	14
AB	9	6
Percentage of types:		
M	—	12
MN	9	42
N	91	46
Frequency of genes:		
p	0·184	0·200
q	0·192	0·097
r	0·614	0·696
m	0·05	0·33
n	0·95	0·67

FIGURE I.

The B factor gene (q) appears to be twice as common in the former area. Differences such as these might have been caused by a long period of isolation; but the

TABLE I.

Blood Group Results in Various Districts in Papua. (Present Survey.)

Administrative Districts.	Number of Villages.	Number of Subjects Tested.	Blood Groups.				Blood Types.			Rh-Positive.
			O	A	B	AB	M	MN	N	
Daru	35	36	17	7	10	2	—	4	32	36
Kikori	36	41	12	13	11	5	—	3	38	41
Kerema	21	23	12	6	3	2	2	7	14	23
Kairuku	15	15	5	7	1	2	3	8	4	15
Port Moresby	8	11	6	2	3	—	—	6	5	11
Rigo	13	14	7	4	3	—	4	6	4	14
Abau	28	28	14	10	3	1	2	11	15	28
Samarai	1	1	—	—	—	1	—	1	—	1
Tufi	6	7	3	4	—	—	—	—	7	7
Kokoda	14	24	15	4	4	1	3	2	19	24
Total	177	200	91 (45·5%)	57 (28·5%)	38 (19·0%)	14 (7·0%)	14 (7·0%)	48 (24·0%)	138 (69·0%)	200 (100·0%)

TABLE III.

Blood-Group Gene Frequencies in the South-West Pacific Area and some Negro Figures for Comparison.

Race (or Locality).	Investigators.	Number Tested.	Frequency of Group Genes.			Frequency of Type Genes.	
			p	*q*	*r*	*m*	*n*
Papuans (Papua)	Present survey.	200	0·186	0·129	0·674	0·19	0·81
Papuans (New Britain, New Guinea *et cetera*)	Heydon and Murphy (1923).	753	0·164	0·104	0·733	—	—
Papuans (South-west coast of New Guinea)	Bijlmer (1935).	500	0·293	0·099	0·613	—	—
Papuans (Schouten Islands)	Bos (1932).	1,359	0·101	0·103	0·794	—	—
Papuans (Merauke)	Kalthofen (*after* Bijlmer).	1,000	0·136	0·106	0·750	—	—
Fijians	Simmons, Graydon and Barnes (1945).	200	0·225	0·120	0·660	0·332	0·667
Indonesians	Simmons, Graydon and Ouwehand (1945).	296	0·146	0·138	0·719	0·532	0·468
Australian Aborigines	Wilson, Graydon, Simmons and Bryce (1944).	649	0·251	0	0·749	0·297	0·703
Australian Aborigines	Simmons, Graydon and Hamilton (1944).	70	0·313	0	0·687	0·300	0·700
Australian Aborigines	Birdsell and Boyd (1940).	805 (730)	0·260	0·014	0·729	0·178	0·822
Samoans	Stephenson (*after* Boyd, 1939).	500	0·103	0·118	0·766	—	—
Negroes (United States of America)	Snyder (*after* Boyd, 1939).	500	0·181	0·133	0·686	—	—
Negroes (Liberia)	Julien (*after* Bijlmer, 1935).	808	0·158	0·136	0·708	—	—
Negroes (United States of America)	Wiener, Belkin and Sonn (1944).	138	0·183	0·132	0·686	0·504	0·496

impression is gained that the natives of the river delta areas may belong to a separate ethnic group.

The 57 samples of group A and the 14 of group AB were found to belong to sub-groups A_1 and A_1B respectively. Thus the sub-group A_2 was absent from our series, and this finding is in agreement with the theory that the B factor found in the blood of Australian aborigines of Cape York Peninsula was derived from Papuan admixture. These Papuans probably came from the nearest point of New Guinea, the Daru-Kikori areas, crossing the straits and then sailing in the protected waters along the north-east coast of Australia. This may account for the high frequency of *n* found by Birdsell and Boyd for the area north of Townsville, which is in the area to which the B factor was largely confined in Australia.

In Table III the blood group gene frequencies found in our series are compared with those reported by others for different parts of New Guinea and for nearby islands of the south-west Pacific area. Figures are also quoted which are considered to be representative for the African Negro races.

It is seen that the Papuans, considered by Bijlmer to be "one of the purest groups of Oriental Negroes", have a blood group picture similar to that of the Negroes of Africa and America in respect of the A, B, O factors. The differences between the gene frequencies of the Papuans and other nearby races are not pronounced except in the case of the Australian aborigines.

This would naturally lead one to expect that the frequencies of the M, N types in the blood of Papuans would be similar to those found in the other south-west Pacific races and in the Negroes, but would differ from those found in the Australian aborigines. That this is not the case is also shown in Table III.

The Papuans have a remarkably low frequency of the *m* gene—even lower than that found in the Australian aboriginal and the Fijian; whereas the Indonesians and Negroes have frequencies closely akin to those of the white and yellow races.

The American Negro also has a particularly high frequency of the sub-group A_2, the highest so far reported for any race (Wiener, Belkin and Sonn, 1944), in contrast to the absence of this factor in the Papuan. These findings appear to place the Papuan in a separate racial category, with a unique blood-grouping picture for which it is difficult to account by theoretical fusion of any two or more of the accepted racial types for which sufficient data are available.

All of the 200 samples tested were agglutinated by the standard anti-Rh_0 serum, "Mrs. C.", but owing to the lack of suitable anti-Rh sub-type sera we were unable to determine the Rh sub-types of the samples. It is hoped that in the future we shall be able to conduct a more complete examination of the Rh factor on a further collection of samples from Papuans and also from representatives of that earlier migration—the Negritos, who have retreated into the central mountain regions of New Guinea before the advance of the later Negroes (Papuan). The Fijian appears to be the closest to the Papuan on these results, differing only in a lower frequency of *n* and a higher frequency of the A factor, both of which may have been brought about in the Fijian by Polynesian influence.

The information we now have on the blood groups in Melanesia makes justifiable a forecast of the gene frequencies in other island groups in this area (the Solomons, the New Hebrides). The gene frequencies *p*, *q*, *r*, *m*, *n*, Rh may be expected to be of the order of 0·2, 0·12, 0·68, 0·25, 0·75 and 1·0 respectively, with a complete absence of the sub-group A_2.

The number of blood group genes which can be detected by objective tests in the laboratory has increased rapidly in the last few years. Of these genes, which are inherited according to simple Mendelian laws, only those determining the Rh factor have been shown to have any natural clinical significance which could influence their frequency by selection. They should, therefore, occupy a preeminent place in the study of racial origins, and future anthropological investigations of living racial groups should, if practicable, include a study of as many as possible of these blood factors.

Summary.

1. Blood samples were examined from 200 Papuans from districts in the territory of Papua where no previous blood-grouping surveys have been made.

2. The group percentages were: group O, 45·5; group A, 28·5; group B, 19·0; group AB, 7·0. All samples of groups A and AB belonged to sub-groups A_1 and A_1B respectively.

3. The type percentages were: type M, 7·0; type MN, 24·0; and type N, 69·0. The frequency of *n* was the highest yet reported for any race.

4. All of the 200 samples tested were Rh-positive.

5. The significance of these results in comparison with figures for other races is discussed, with special reference to the Australian aborigines and the Negroes.

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TOXÆMIA.

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IRRESPECTIVE of the causative agent—bacterium, virus or protozoon—every infectious disease is ushered in and its pathognomic symptoms are accompanied by a syndrome consisting of fever, wasting, anæmia, depression and symptoms referable to the central nervous system. In common parlance this syndrome is designated as toxæmia, and although characteristic for infection, it occurs occasionally in non-infective processes, such as uræmia, leuchæmia, severe burns and other morbid states.

Most studies concerned with the action of bacterial toxins take into account only their specific effect, whereas the general symptoms of toxæmia are usually disregarded. This concentration on specific effects is understandable, because measures for diagnosis, prevention and therapy of infectious diseases are almost exclusively of a specific nature, and practically all attempts at non-specific therapy and prophylaxis have been unsuccessful.

The problem of the pathogenesis of toxic symptoms is closely linked with the problem of natural resistance. The susceptibility of different animal species to the same noxious agent varies widely, and of two closely related species one will be found to be highly susceptible and the other resistant. On the other hand, species as far apart as man and mosquito may be susceptible to the same infection. Somewhat less accentuated are variations in resistance between single individuals of the same species; but again no experimental evidence is available which could furnish an explanation of these discrepancies.

The problem is further complicated by the influence of extraneous factors, such as temperature, nutrition, exertion *et cetera*.

The vague and often conflicting evidence concerning the importance of various endogenous and external factors which favour or suppress the development of toxæmic symptoms cannot be discussed here. Most of the relevant information has been summarized by Perla and Marmorston,[1] and suffice it to state that from a mass of observation only two facts have been generally accepted—namely, the importance of a diet rich in protein and vitamins for the maintenance of optimal resistance, and the recognition that although protein and vitamins are essential, their administration does not raise above normal resistance against infection or toxins.

The formulation of definite questions along new lines of approach was prompted by investigations undertaken during the last three years on the biological detoxication of toxins and their pathogenic effects. For experimental details and the relevant literature the reader must be referred to papers in *The Australian Journal of Experimental Biology and Medical Science*.[2][3][4][5][6][7][8] A general outline of the facts and a discussion of a hypothesis which may be based on these observations are given below.

1. The biological detoxication of bacterial toxins is closely linked with the oxidation of normal substrates by the metal-containing oxidative enzymes of the cell.

It has been known for a number of years that in media which are used for toxin production the concentration of certain inorganic constituents, such as manganese, iron and copper, must be rigidly controlled. When this is too low, growth of the bacilli is suboptimal and toxin production weak; an excess favours luxuriant growth, but no toxin can be demonstrated in the filtrate. For a certain semi-synthetic medium which is at present widely used for the production of diphtheria toxin, the optimal concentration of iron varies only in the extremely narrow limits of 0·0001 and 0·0004 milligramme per millilitre. It was generally assumed that an excess of iron inhibited the formation of toxin, but experiments at this institute designed to investigate the effect of metals on experimental diphtheritic infection of guinea-pigs led to an entirely different conclusion. When toxin-free diphtheria bacilli sufficient to produce a necrotic zone one centimetre in diameter within forty-eight hours are injected into the guinea-pig skin together with various metal compounds, the resulting reaction is reduced to a slight redness and infiltration without necrosis.

These findings are exemplified by the results shown in Table I.

TABLE I.

Effect of Metals on Intradermal Diphtheria Infection of Guinea-pigs.

Compound Tested.	Microgrammes of Metal.	
	Tolerated.	Effective.
Ferrous sulphate	50	1–2
Ferric citrate	34	8–17
Potassium ferrocyanate	500	500[1]
Potassium ferricyanate	500	500[1]
Hemin	4·5	0·45
Ferritine	50	2·5
Hæmoglobin	10	5·5
Zinc sulphate	50	15·0
Copper sulphate	25	10·0
Cobalt sulphate	25	(Inactive)
Nickel sulphate	50	(Inactive)
Manganese sulphate	25	(Inactive)

[1] No necrosis, but reaction stronger than with ferrous sulphate or other ionizable iron compounds.

It seemed unlikely that such minute amounts of metals could influence the metabolism of a virulent parasite within the living animal body, and further experiments demonstrated that these metals do not inhibit production, but destroy toxin as soon as it is released from the bacilli and before it can exert its effect on the skin.

TABLE II.

Microgrammes of Metal Effective in Preventing the Skin-Reaction Caused by Diphtheria Toxin in the Guinea-pig.

Compound Tested.	Diluent.		
	Saline Solution.	Broth.	50% Rabbit Serum.
Ferrous sulphate	10	10	2·5
Ferric citrate	(Inactive)	(Inactive)	(Inactive)
Cytochrome C	6	—	—
Hæmoglobin	(Inactive)	—	—
Copper sulphate	(Inactive)	(Inactive)	2·5
Zinc sulphate	(Inactive)	(Inactive)	2·5
Cobalt sulphate	(Inactive)	(Inactive)	(Inactive)
Nickel sulphate	(Inactive)	(Inactive)	(Inactive)
Manganese sulphate	(Inactive)	(Inactive)	(Inactive)

Two more relevant facts were observed: metal-protein complexes are more effective than inorganic compounds,

and cytochrome C, which is part of the oxidative enzyme system, is highly active, whereas hæmoglobin in ineffective.

These experiments proved that iron, copper and zinc compounds were able to detoxify diphtheria toxin in the guinea-pig skin, but gave no indication concerning the actual mechanism of toxin destruction.

Experiments *in vitro* showed that the metal compounds had no effect on diphtheria toxin unless some redox substance, such as ascorbic acid, adrenaline, glutathione or hydrogen peroxide, was present at the same time.

TABLE III.

Metals and Activators for the Detoxication of Diphtheria Toxin in Vitro.

Metal.	Activator.			
	Ascorbic Acid.	Adrenaline.	Glutathione.	Hydrogen Peroxide.
Iron	+[1]	+	0[1]	+
Copper	+	+	+	+
Zinc	+	+	0	+
Manganese ..	0	0	0	+

[1] "+" = destruction of toxin; "0" = no destruction of toxin.

In experiments on mice it could be shown that the same metals which were found to be active in the guinea-pig skin and *in vitro* had a remarkably strong curative effect in generalized severe intoxication.[6] A further interesting observation was the fact that different toxins reacted with the tissues of the guinea-pig at different speeds: staphylococcal toxin reacted instantaneously, diphtheria toxin reacted within four or five hours, and *Clostridium welchii* toxin occupied an intermediate position. It is likely that this varying speed of reaction constitutes the reason for the severe local effects of a staphylococcal infection and for the general toxæmia and trifling local symptoms of diphtheria.

The results of these studies can be summarized as follows. Iron, copper, zinc and manganese are able to detoxify bacterial toxins *in vitro* when certain redox substances or hydrogen peroxide are present as activators. The same phenomenon can be observed *in vivo*, the living tissue apparently furnishing the redox substances necessary for detoxication. Substances which do not occur in the living body, such as ferrous sulphate, and body constituents, especially cytochrome C, have the same effect. Therefore it may be deduced that the metal-containing oxidative enzymes, especially the cytochrome/cytochrome-oxidase system, are implicated in the biological detoxication of bacterial toxins. This should not be construed to mean that the toxins act as substrates for these oxidative enzymes, but rather that the detoxication is linked with the oxidation of normal substrates.

2. The oxidative enzymes occur in the form of distinct granules of high lipid content which are severely damaged during the course of an infectious disease or during toxæmia.

That the oxidase granules of the polynuclear leucocytes disappear in severe infectious diseases has been known for at least thirty years; but the importance of this observation could not be appreciated, and it assumed significance only after it had been demonstrated that the oxidases were essential for the detoxication of bacterial toxins.

In the various organs the oxidase granules assume different shapes, and their location within the cell is characteristic for each organ. In the heart the oxidases are located in the A disks and Z disks. Apart from these regular granules, a few perinuclear granules can be demonstrated. The cytoplasm of the liver cells is filled with fine granules of slightly irregular size and form. The nuclear membrane and the nucleoli give a positive oxidase reaction. In the kidney the distribution of the oxidase granules is similar, the proximal and distal convoluted tubules giving the strongest reaction, whilst the glomeruli, Henle's loop and the collecting tubules give only a weak reaction. In the adrenals the oxidase granules are located exclusively in the cortex. The *zona fasciculata* and *zona reticularis* give a strong oxidase reaction, whereas the *zona glomerulosa* reacts less strongly and the medulla is free of oxidase granules.

All these oxidation points in the leucocytes or organs can be stained with Sudan III or scarlet red, the histological picture obtained with the true oxidase stains and the lipid stains being almost identical.

In infection the ability of the granules to react with oxidase stains and lipid stains tends to disappear, and the oxidases are released and carried away by the venous blood. In some organs granules giving oxidase reaction appear in abnormal locations.

These results furnish proof that the oxidase granules are affected during infection or toxæmia, and the fact that the lipid content and the oxidase content of the granules suffer in an identical fashion is significant when considered with the observations given in the next paragraph.

3. Lipid extracts from organs and leucocytes of the rat can detoxify diphtheria toxin, whereas similar extracts from guinea-pig organs and leucocytes are inert.

The specific effect of different toxins can vary widely, but there are numerous indications that toxins interact with lipid constituents of the tissues. Some, as for instance tetanus, botulinus and Shiga toxins, show special affinity for the central nervous system; diphtheria toxin chiefly affects peripheral nerves; the α toxin of *Clostridium welchii* and cobra venom are lecithinases, and many other toxins are strongly hæmolytic. On the other hand, it has been known for a considerable time that cholesterol and similar compounds are able to protect red cells against the hæmolytic effect of certain snake venoms, and the detoxifying effect of sterols has lately been demonstrated in the case of diphtheria toxin.

Investigations concerning the effect of organ lipids for for detoxication of toxins were therefore indicated, particularly as lipids constitute an essential part of the oxidase granules which are affected during toxæmia.

It could easily be demonstrated that the residue from alcohol-ether extracts prepared from rat organs was able to detoxify considerable amounts of diphtheria toxin, when the extractives were mixed with toxin solutions in isotonic phosphate buffer solution and the mixture was incubated for five hours at 37° C. Under the same conditions extractives from guinea-pig organs and leucocytes were ineffective.

A representative experiment is given in Table IV.

TABLE IV.

Action of Organ Lipids of Rat and Guinea-pig on Diphtheria Toxin. Experiment with Residues of Ether-Soluble Fraction of Alcohol-Ether Extracts.[1]

Extractives.	Action and Number of Units Injected.		
	5·0	2·5	1·0
10 Grammes:			
Rat liver	±[2]	0[2]	0
Guinea-pig liver ..	+[2]	++	+[2]
3 Grammes:			
Rat liver	++	+	0
Rat muscle	++	±	0
Rat skin	++	±	0
Rat blood	++	+	±
Guinea-pig liver ..	++	++	+
Guinea-pig muscle ..	++	++	+
Guinea-pig skin ..	++	++	+
Guinea-pig blood ..	++	++	+

[1] All tests were performed in two millilitres of isotonic M/30 phosphate buffer solution, pH 6·5, containing 50 units (skin test doses) of diphtheria toxin per millilitre, incubated for five hours at 37° C.

[2] "++" signifies reaction corresponding to more than one unit of toxin; "+" signifies reaction corresponding to one unit of toxin; "±" signifies reaction corresponding to less than one unit of toxin; "0" signifies no reaction.

Suitable controls excluded the possibility that the admixture of lipid substances prevented the reaction of the injected toxin with the guinea-pig skin. Extractives of five grammes of organ together with one unit of diphtheria toxin, injected immediately after being mixed, resulted only in a slight modification of the reaction without any appreciable lessening in severity.

In further experiments an attempt was made to characterize the substance or substances responsible for the detoxifying effect. Fractionation of the crude extracts with acetone showed that the acetone-insoluble phospho-lipid fraction was devoid of activity.

Saponification of the acetone-soluble fraction with sodium alcoholate resulted in a division into an inactive saponifiable fraction, a weak activity remaining in the non-saponifiable part. It is possible, therefore, that some active substances had been destroyed by the saponification, or else that the impossibility of procuring a fine and stable suspension of the non-saponifiable matter in the toxin solutions may be the explanation of its weak effect.

Even when these preliminary attempts at further characterization of the detoxifying substance or substances have been unsuccessful, the fact that alcohol-ether extracts from tissues of a resistant species are able to detoxify diphtheria toxin, whereas similar extracts from the organs of the susceptible guinea-pig are inert, furnishes a new and interesting approach to the obscure problem of natural resistance. Furthermore, these results provide proof that not only the oxidative enzymes which are the essential part of the oxidase granules, but also the lipid constituents play an important part in detoxication and in the pathogenesis of toxæmia.

Discussion and Summary.

When one considers the facts that have been discussed in the previous paragraphs, the following hypothesis concerning the action and detoxication of bacterial toxins in the body of the living animal appears to be self-evident.

The primary pathogenic effect of bacterial toxins may be located at lipid constituents of the cell. The effect on the lipids of the oxidase granules in a susceptible species would produce the general non-specific symptoms of toxæmia; the effect on specialized cells in the nervous system, red cells *et cetera*, which varies with the toxin, would provide the specific symptoms.

In a resistant species certain lipid constituents are able to detoxify the toxin before it can reach and damage the oxidative enzymes.

In a susceptible species the lipids are unable to detoxify the toxin, the granule is damaged and under extreme conditions disappears completely, its oxidative enzymes being released. Such a change is incompatible with the proper function or even with the survival of the cell.

Moderate toxæmia, which does not lead to complete destruction of the oxidase granule, might (for example, by increasing its permeability) cause an increased accessibility of the oxidative enzymes to various substrates, some of them of larger molecular size, and in this way furnish an explanation for the increased rate of oxidation and the extensive destruction of body protein in infectious diseases.

In sublethal toxæmia the toxins are detoxified by the persisting activity of the oxidative enzymes, the detoxication being closely coupled with the oxidation of normal substrates.

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Reports of Cases.

A CASE OF ETHER CONVULSIONS.

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Clinical Record.

T.A., aged nine years and ten months, was admitted to the Adelaide Children's Hospital on August 21, 1944, suffering from acute appendicitis. He had had loss of appetite, malaise and occasional pain round the umbilicus for two or three weeks. Forty-eight hours before his admission to hospital he "became sick" and vomited several times, and the vomiting continued. He had two loose bowel actions on the day of his admission to hospital. On subsequent questioning his parents said that he had been drowsy for several days. He had been immunized against diphtheria, and his previous illnesses included measles, whooping cough, mumps, chicken-pox, bronchitis, tonsillitis, summer diarrhœa, ringworm and "seasonal sores". Nothing relevant was elicited in his family history; there was no tuberculosis among the relatives.

On his admission to hospital, his temperature was 104° F., his pulse rate was 144 per minute, his respirations numbered 24 per minute and he had fairly definite abdominal signs of acute appendicitis. It was decided to operate. The anæsthetic induction was carried out with ethyl chloride, the change over to ether being made in the normal way. During the early part of the ether administration violent generalized spasms developed, which were regarded as "ether convulsions". These persisted more or less continuously despite all efforts to control them. He was anæsthetized more deeply without relief, oxygen and chloroform being given. None of these measures relieved the convulsions, so that after a long period of waiting it was decided to operate despite them. Throughout the operation he continued in violent clonic convulsions. The appendix was gangrenous at the tip and had ruptured, and some purulent fluid was present in the peritoneal cavity.

After the operation, the boy was given "Carbogen" inhalations, one cubic centimetre of "Coramine", 1·5 grains of "Luminal" intramuscularly, one one-hundredth of a grain of atropine, and calcium gluconate, ten cubic centimetres intravenously; the administration of saline solution by the intravenous drip method was also begun, as the convulsions were now fewer and feebler.

Next day (August 22) he was still unconscious; his pupils were equal and active. A catheter specimen of urine was normal, and Babinski's sign was present on the right side. He was given 13,000 units of gas-gangrene antiserum through the intravenous drip apparatus. In the afternoon further tetanic spasms developed, and he became deeply unconscious, and the left pupil was larger than the right. He was given five cubic centimetres of a 10% solution of calcium gluconate and one grain of "Luminal" intramuscularly.

Next day (August 23) his condition was the same; his arms were still stiff and his fundi were normal. The systolic blood pressure was 120 millimetres of mercury and the diastolic pressure was 80.

Next day (August 24) he was still unconscious, but he gave some mumbling response to spoken words. His plantar responses were now both flexor in type. He was fed through a stomach tube passed through the nose.

On August 25 he was still unconscious. His pulse rate was 130 per minute and his temperature had risen to 103° F. He was having occasional tonic spasms, with tetanic characteristics in the hands. By lumbar puncture the cerebro-spinal fluid was found to be under considerable pressure, but clear; thirty cubic centimetres were withdrawn.

The examination of the cerebro-spinal fluid showed that it contained less than one leucocyte per cubic millimetre; the chloride content was 660 milligrammes per 100 cubic centimetres and the protein content 30 milligrammes per 100 cubic centimetres; the globulin content was not increased. Sugar was present, and the fluid was sterile.

In the afternoon the boy was able to obey orders, such as "put out your tongue". The sulphapyridine which he had been having till this stage was changed to sulphadiazine. He was now being given magnesium sulphate enemata each day (six ounces of a 50% solution), phenobarbital (one grain every eight hours by intramuscular injection), calcium gluconate (five cubic centimetres twice a day) and a light diet. His condition improved till August

28, when he was having more spasms; his temperature was 100° F., the left pupil was larger than the right, the plantar reflexes were flexor in type, and he did not respond to orders.

On August 29 his condition was unchanged. Sugar, but no acetone, was present in the urine. The blood sugar curve began at 0·14, rose to 0·17 thirty minutes after the glucose had been given, and fell to 0·14 in two hours.

On August 31 his condition seemed worse, his breathing being stertorous. He was given 50 units of insulin and 50 grammes of glucose. His urine was normal.

On September 1 he was unconscious. Lumbar puncture was performed, and six cubic centimetres of cerebro-spinal fluid were withdrawn. Examination of the fluid revealed a slight increase in the number of leucocytes, and in the total protein and globulin content, as compared with the first examination.

A Mantoux test with 1/1,000 strength tuberculin failed to produce a reaction. The hæmoglobin value of the blood was 70% (Sahli), and the white cells numbered 8,100 per cubic millimetre.

The sulphadiazine treatment was discontinued.

On September 4 the boy was noisy. Examination of the blood gave the following information: the erythrocytes numbered 3,600,000 per cubic millimetre and the white cells 14,200 per cubic millimetre, 85% being polymorphonuclear cells, 13% lymphocytes and 2% monocytes.

On September 9 his temperature rose to 102° F. and the spasticity was increasing. He was lying with his head almost touching his knees. Despite his extremely serious condition, it was considered necessary at this stage to do something about the contractures which were developing, so he was put on a frame with arms and legs extended. He responded quite well to orders. Physical therapy was commenced.

On September 29 the spasticity was decreasing. The "Luminal" dosage was reduced to 0·5 grain three times a day. He was gaining considerable use of his arms. His legs were rigid. He was trying to speak, and appeared to understand conversation to a certain extent.

On October 26 he was still on the frame, playing happily with toys. Apart from not having full extension of his elbows, his arms were strong and moving normally. Gross wasting of all his muscles was present, with extreme spasticity of the legs. His knee and ankle jerks were exaggerated and his plantar reflexes equivocal.

By October 31 he was able to speak a few words with encouragement, and his mentality was that of a young child. The appendix wound healed normally by the end of fourteen days.

Comment.

It is suggested that the condition could be accounted for by thrombosis of the superior longitudinal sinus, and it appears unlikely that a complete recovery can be expected. The child was later moved to a home for patients with chronic orthopædic conditions, where his treatment will be continued indefinitely. It is reported from there that his condition has improved considerably (March 15, 1945). On account of the extreme rarity and gravity of the condition it is considered worthy of record.

CRYPTOGENIC STAPHYLOCOCCAL PYÆMIA.

By H. A. S. VAN DEN BRENK,
Melbourne.

Clinical Record.

G.W., a male mechanic, aged seventeen years, was admitted to the Alfred Hospital under the care of Dr. M. D. Silberberg on January 8, 1945. He had been taken ill on December 24, 1944, and treated in a district hospital as suffering from rheumatic fever. The onset of his illness took place four weeks after dental extractions, and commenced with shivering and severe pain down his back and down the backs of both legs. When he was first examined, his temperature was 103° F., and he complained of pain in several joints. He was given salicylates, and the pyrexia subsided in a few days; but some days later his temperature was again elevated, and he complained of a persistent pain in the region of his left hip joint. Salicylate therapy was stopped and he was given sulphapyridine; but he became cyanosed after eight grammes had been administered; his temperature was still elevated and he was complaining of night sweats.

On admission to the Alfred Hospital, the patient was pallid but also cyanosed. His temperature was 100° F.; his pulse rate was 104 per minute and his respirations numbered 22 per minute. His heart was not enlarged, and no bruits were audible; the chest and abdomen were clinically normal, but his left hip joint was extremely painful on active or passive movement and tender over the posterior part of the capsule, although no swelling could be detected. His right elbow, although neither hot nor swollen, was painful on movement, particularly extension, being held in a position of semi-flexion. Further interrogation of the patient at this time revealed that he had had a tonsillectomy as a child, and had not suffered previously from joint aching or pains. The patient disclosed that his mother suffered from heart disease, there being several cases of rheumatic fever on the maternal side of the family, and his father had contracted pulmonary tuberculosis after the Great War, but had now fully recovered.

The patient's urine was examined and found to be clear, both macroscopically and microscopically; the specific gravity was 1,016, and the urine was free from sugar and albumin. The hæmoglobin value of his blood on his admission to hospital was 80% in capillary blood.

In view of the patient's past history he was given a further trial of salicylate therapy. However, although the cyanosis diminished after a few days in hospital, and the pain had somewhat subsided, the temperature remained elevated and swinging in character, the daily maximum being 103° or 104° F. The treatment was now changed to the administration of calcium aspirin, but without response. During this time his left ankle became tender and also his right hip, although neither joint was swollen.

Ten days after his admission to hospital the patient had become pale and miserable; but the cyanosis had almost completely disappeared. A blood examination made at this time revealed a hæmoglobin value of 60%, and the erythrocytes numbered 3,500,000 per cubic millimetre. The blood film was normal except for a pronounced leucocytosis of polymorphonuclear type, no immature cell types being present. The leucocytes numbered 23,000 cells per cubic millimetre; the differential count disclosed a pronounced neutrophile polymorphonuclear leucocyte preponderance of 75%. Blood taken for cultural examination on January 17 yielded no growth of microorganisms. At this time, a tender swelling was noted in the lower end of the right *biceps brachialis* muscle; it was rather hard and indurated, but not attached to the humerus, and an enlarged, tender, epitrochlear gland was also palpable. Limitation of extension was pronounced. A further attempt at culture of microorganisms from the blood three days later still gave negative results. A radiograph of the right elbow revealed no joint or bone lesions.

During this time also the patient complained that the pain in his right ankle had extended up the calf of his leg, and tenderness was present over the *tibialis anterior* and perineal muscles, although little tenderness was elicited over the bone. A radiograph of the right tibia and fibula revealed no abnormality of the bone. The pain in the patient's left hip now seemed mainly confined to the buttock in the gluteal mass of muscles when active and passive joint movements were induced, and this was also the site of maximum tenderness, although no actual swelling or fluctuation could be felt.

A review of the case at this stage, about four weeks after the onset of the illness, rendered a diagnosis of rheumatic fever untenable. Failure to grow microorganisms from the blood on two successive occasions did not give much support to the diagnosis of septicæmia with metastatic abscesses, which had been already suspected. Hence it was proposed that the lesion was possibly one of the rarer conditions, such as *periarteritis nodosa* or dermatomyositis, presenting as an atypical syndrome. Moreover, at this stage further interrogation of the patient revealed that a few weeks prior to the onset of his illness he had suffered from an outcrop of "pimples" across his back and shoulders, which were, however, only small, and rapidly subsided without treatment.

A few days later the site of tenderness in his right calf became swollen and fluctuant, and aspiration produced thick, yellow pus. On microscopic examination the pus was found to consist of polymorphonuclear cells and staphylococci; examination of a film stained by Ziehl-Neelsen's method failed to reveal the presence of tubercle bacilli. The pus on culture yielded a pure growth of *Staphylococcus aureus*, sensitive to penicillin.

Penicillin therapy was commenced, and 15,000 units were given intramuscularly every three hours. The abscess in the right calf was incised and drained, thirteen ounces of staphylococcal pus admixed with blood clot being evacuated. The abscess extended throughout the muscle mass and contained no sequestra, nor did it appear to originate from

the bone or periosteum. A biopsy of material removed from the wall of the abscess revealed only blood clot admixed with polymorphonuclear leucocytes. At the same time a further attempt at culture from the blood yielded a growth of *Staphylococcus aureus*.

On the day following drainage of the abscess, the temperature had subsided, but two days later it was again elevated to 103° F., and the left buttock was tender, although no actual site of fluctuation was found. A diagnostic aspiration of the tender site revealed deep-seated pus, and the buttock was incised and a large abscess opened beneath the deep fascia in the site of the gluteal musculature. Sixteen ounces of staphylococcal pus were evacuated. During this time the hæmoglobin value of the blood had fallen to 50%, and he was given a pint of blood by direct transfusion, followed a few days later by two pints of stored blood. Radiographs taken of the lumbar portion of the spine, the pelvis and the hip joints revealed no bone or joint abnormality. When the abscess in the buttock was drained, the amount of penicillin administered had totalled 1,500,000 units, and the dose was increased to 20,000 units intramuscularly every three hours. A few days later the patient's temperature was normal, and it has not been elevated since. A total of 2,370,000 units of penicillin were administered.

During the interval of penicillin therapy the swelling in the patient's right *biceps brachialis* muscle resolved without drainage. A radiograph of the patient's upper and lower jaws failed to reveal the presence of root stumps, but an incompletely erupted wisdom tooth was present in each jaw.

The patient was discharged to a convalescent hospital on February 21, eight weeks after the onset of his illness. He was ambulatory and free from pain. His colour had improved, the hæmoglobin value of his blood having risen to 85%, and he had gained in weight. Both abscesses were completely healed but for a small granulating scar.

Summary.

The case reported is one of cryptogenic staphylococcal pyæmia, successfully treated by penicillin therapy. A feature of interest in connexion with this case is the resemblance to rheumatic fever manifested in the early stages.

Acknowledgement.

My thanks are due to Dr. M. D. Silberberg for permission to report this case.

Reviews.

THE SCIENCE OF A COUNTRY DOCTOR.

ARTHUR E. HERTZLER has written an entertaining book on his experiences and studies covering a period of fifty years.[1] He tells us that the reason for writing this summary is that he has seven granddaughters and grandsons heading for the life of the medical profession. Apart from personal experiences the book has been written to show these relatives and others the pleasure and interest that Dr. Hertzler has received from extensive studies in the fundamental sciences, and he has tried to show their relation to the life of a surgeon. He states that the book is a frank confession of approaching senility, but he excuses it by the observation that he is "trying to tell young doctors how much fun one can get out of pursuit of the science of medicine in simple surroundings, neither helped nor hindered by the great universities". The subjects of the chapters show the diversity of his research—the peritoneum, wound healing, anatomy, surgical pathology, local anæsthesia, chronic appendicitis, operations on the uterus, prostate and rectum, goitres, bursitis, neuralgias and a number of miscellaneous problems. This list might appear dull, but the author has enlivened his pages by using an autobiographical form with many humorous stories and happy turns of phrase.

Towards the end of the book he gives some interesting chapters on the collecting of material and the writing of books, accompanied by a rather immodest "photograph of the books written by me". We stand amazed at his industry in assembling notes and abstracts (about 70,000 cards) and microscope slides—but these are obviously the secret of his wide knowledge and literary fertility.

The most interesting parts of the book—apart from the purely technical matter—are the sentences and paragraphs scattered throughout the book which reveal the author to us. Though many believe it is an outworn creed, Dr. Hertzler has the humanistic approach to life. Dr. Raymond Allen, dean of the University of Illinois, in his foreword to this book, indirectly gives us a picture of Dr. Hertzler when he writes: "The precept and example of a good teacher is a day to day reminder that fearless intellectual honesty—being true to oneself—is a standard of conduct and viewpoint which is good at all times and in all places."

[1] "Ventures in Science of a Country Surgeon", by Arthur E. Hertzler, M.D.; 1944. 9" × 6", pp. 302, with illustrations.

THE SICK AFRICAN.

DR. M. GELFAND has produced a really useful book on the sick African.[1] It is a clinical study on the aboriginal of Africa and has been designed particularly for Europeans coming into contact with the native for the first time. It is written primarily for the medical profession, but will also be of service to missionaries and native medical orderlies who do so much of the medical work in a land like Africa.

Writing from a purely clinical point of view, the author has deliberately omitted most of the details of helminthology, protozoology and parasitology which encumber the pages of the larger text-books—these latter can be consulted when necessary in any case. He has attempted (and, we think, succeeded) in showing how best to treat the African patient in the most practical and simple way, in keeping with the difficulties of native practice.

The first chapter is an excellent introduction to the subject and will be of great help to medical workers in Africa. It deals with the health, life and outlook of the native, and the difficulties met with in native medical practice. It discusses the various diseases of the European and native in Africa, in respect of their frequency, their clinical differences and their geographical distribution. The second chapter deals with the examination of the patient and contains special reference to African conditions. Following this the rest of the book covers the general ground of medical practice in Africa. We think that several chapters could be added dealing with the eye and with gynæcology, and we also think that the present chapter on children could be considerably enlarged.

The printing of the book is reasonably good and many of the illustrations are excellent. The present arrangement of having illustrations representing many diseases grouped together as one section is difficult for reference. We hope that when printing problems are easier it will be found possible to space them through the book.

AN ATLAS OF BLOOD DISEASES.

THE fifth edition of a "Clinical Atlas of Blood Diseases" by A. Piney and Stanley Wyard was published in 1942. We are surprised to find that a sixth edition has become necessary in such a short space of time.[2]

"It is with peculiar gratification", states the authors' preface, "that we offer to our readers the sixth edition of this Atlas. . . . It is not intended for those hæmatologists who know more about the subject than we; but its aim is to serve others, either by adding even a little to their knowledge, or by recalling facts which have momentarily slipped their memory, or by stimulating them to seek further information in the literature. As its name states, this is an Atlas, not a literary effort." The preface concludes by supplying information about magnification and staining which was missing from the fifth edition. A note about the Rh factor has been added to the account of erythroblastosis. There is still no list of illustrations, which seems a pity, as the book is mainly a collection of coloured plates; the letterpress is a very secondary affair.

Some of the plates are quite good; others, such as plate 30 (glandular fever), are very bad. And why devote a coloured plate to the blood in Hodgkin's disease in which the blood picture varies widely and is useless for diagnosis? However, with all its faults, this book is a handy little volume and will no doubt be consulted more often than weightier and more serious works.

[1] "The Sick African: A Clinical Study", by Michael Gelfand, M.B., Ch.B., M.R.C.P., D.M.R.; with a foreword by A. P. Martin, O.B.E., M.D., D.P.H., D.T.M. and H.; 1944. Cape Town: The Post-Graduate Press, in association with The Stewart Printing Co. (Pty.) Ltd. 8½" × 5½", pp. 383, with 129 illustrations. Price: 25s.

[2] "Clinical Atlas of Blood Diseases", by A. Piney, M.D., M.R.C.P., and Stanley Wyard, M.D., F.R.C.P.; Sixth Edition; 1945. London: J. and A. Churchill Limited. 8" × 5¼", pp. 146, with 48 illustrations, 45 in colour. Price: 16s.

The Medical Journal of Australia

SATURDAY, JULY 21, 1945.

All articles submitted for publication in this journal should be typed with double or treble spacing. Carbon copies should not be sent. Authors are requested to avoid the use of abbreviations and not to underline either words or phrases.

References to articles and books should be carefully checked. In a reference the following information should be given without abbreviation: initials of author, surname of author, full title of article, name of journal, volume, full date (month, day and year), number of the first page of the article. If a reference is made to an abstract of a paper, the name of the original journal, together with that of the journal in which the abstract has appeared, should be given with full date in each instance.

Authors who are not accustomed to preparing drawings or photographic prints for reproduction are invited to seek the advice of the Editor.

AUSTRALIAN RESEARCH IN INDUSTRY AND MEDICINE.

THE eighteenth annual report of the Council for Scientific and Industrial Research for the year ended June 30, 1944, is an intensely interesting document. The place of the council in Australian national life and the enormous benefits conferred by it upon the community are not sufficiently known or recognized. Possibly quite a number of Australians do not know of the council's existence. Science is indispensable to progress and the people should know how it is that many of the amenities taken for granted have been secured. There is scarcely a branch of national industrial pursuit that does not owe something to the labours of scientists. At the heading of this year's report, which is a seventy-eight page document, we are informed that a very considerable part of the council's activities is devoted to the solution of problems arising out of war and to assistance and advice to government departments and other institutions and organizations concerned with the war effort. This applies particularly to the Council's National Standards Laboratory and to its divisions dealing with aeronautics, forest products, industrial chemistry and radiophysics. As some of the work done in these fields must be kept from the enemy, reference to it in the present report is either confined to a brief statement or omitted entirely. For those who are not aware of the scope of the council's activities, it may be stated that it was established in 1926 by the reorganization of a body known as the Institute of Science and Industry. The principal powers and functions are stated in the "Official Year Book of the Commonwealth of Australia" to be as follows:

1. The initiation and carrying out of scientific researches in connexion with primary or secondary industries in the Commonwealth.
2. The training of research workers and the establishing of industrial research studentships and fellowships.
3. The making of grants in aid of pure scientific research.
4. The establishment of industrial research associations in any industries.
5. The testing and standardization of scientific apparatus and instruments.
6. The establishment of a bureau of information.
7. The function of acting as a means of liaison between the Commonwealth and other countries in matters of scientific research.

The plant investigations of the last year cover a wide field. Pastures and weeds have been dealt with, and also plant introduction. Work on wheat has been continued, and fruit, tobacco, vegetables and potatoes have received attention. Of special interest to medical practitioners is the work on drug plants. This is carried on in cooperation with the Department of Physiology of the University of Melbourne and the Department of Pharmacy of the University of Sydney, and under the ægis of the Medical Equipment Control Committee and the National Health and Medical Research Council. It was recently described in this journal by Sir Alan Newton, chairman of the Medical Equipment Control Committee. The entomological investigations are described under no less than nineteen headings. They have covered insect pests of plants and animals. The subjects discussed include the insect pests of stored wheat, the blowfly problem in sheep, cattle tick, medical entomology and the insect vectors of plant virus disease. The council has been able to be of service to the Australian and Allied forces in regard to the control of insect pests. The work of the Division of Animal Health and Nutrition has been carried out as previously at the three main centres at Sydney, Melbourne and Adelaide, and at field stations in Queensland, New South Wales and Victoria. Among the diseases studied have been pleuropneumonia of cattle, caseous lymphadenitis of sheep, mastitis in dairy cattle, toxæmic jaundice in sheep, peg-leg of cattle and contagious abortion of cattle; animal parasites have also been studied. Soil investigations, irrigation settlement investigations and forest product investigations have been made. The activities of the division dealing with food preservation have been centred almost entirely on problems of direct importance in the war effort. Four aspects of the investigations are described—those dealing with meat, canning and fruit products, dehydrated foodstuffs and microbiological matters. The dehydration of foodstuffs is a subject about which a great deal will be heard in the future. Vegetables and meat are the commodities chiefly concerned, and the council has had the cooperation of the Department of Commerce and Agriculture. On the work of the Division of Fisheries a chapter might easily be written. It must suffice to point out that departmental activities have centred chiefly round (*a*) the shark-oil industry (of importance for the vitamin content of the oil), (*b*) the seaweed industry for the production of agar-agar, (*c*) the trawling of fish in Tasmanian waters, (*d*) the making of tests on methods of catching pelagic fish. The other work of the council includes the activities of the National Standards Laboratory, investigations in aeronautics, industrial chemistry, lubricants and bearings, and radio research. The money expended by the council during the year under review totalled £682,849. Of this amount, a sum of £115,888 was contributed by bodies other than the Commonwealth Treasury. This extra money was provided by certain sections of industry for cooperative research. The remuneration of the chairman and members of the council, which is provided from consolidated revenue, came to £2,578. Salaries and contingencies (these include travelling expenses, printing and general office expenditure) cost £62,386.

It is clear that the Council for Scientific and Industrial Research is a body of which every citizen of the Commonwealth has reason to be proud. At the same time it must be remembered that even a body so carefully organized and expertly controlled cannot stand still. The three executive officers, scientists of high repute, who are nominated to their positions by the Commonwealth Government with the other members of the council, appointed by reason of their scientific attainments, control its destinies, and there is no reason to suppose that the present *modus operandi* will not be continued and extended as need arises. The council is fortunate in that in many of its spheres of activity it can produce tangible results. Its appeal, moreover, has to do with questions of national repute, of industrial efficiency and of financial gain. Any governmental interference with so active and productive a body would be an egregious display of lack of wisdom. Medical men and women cannot fail to contrast the treatment of research in industry with the parsimonious way in which medical research is handled in this country. A sum of £30,000 expended in one year on medical research by the National Health and Medical Research Council is thought to be sufficient. When we think that for every pound spent by the Government of the country on research into the cause and prevention of disease affecting man, two hundred pounds are spent to place man's industrial and other activities on a surer foundation, we must ask ourselves why this should be. The perspective is wrong. No one will find fault with generosity in general scientific and industrial research, but in the face of the wrong perspective the question must arise, how much of the large sum of money is spent with the object of making Australia a better and happier country in which men and women shall live and work and die. No one will want to think that the sole object is national aggrandisement and the acquisition of wealth. There is reason to hope that a medical research council may be brought into being as a body independent of the present National Health and Medical Research Council. If this should happen it should be planned in such a way as to display a discriminating sense of values as between man himself and his activities.

Current Comment.

THE SURGICAL TREATMENT OF OTOSCLEROSIS.

OTOSCLEROSIS has been described by Wakeley and Buxton as a disease of uncertain causation, but probably an extremely mild and slowly progressing inflammation of the bony capsule of the internal ear and in particular of that part which surrounds the cochlea. The changes in the bone are in the nature of an osteoporosis in which superabundant new bone is laid down. J. S. Fraser points out in Logan Turner's text-book that at first the normal bone is absorbed and replaced by vascular spongy osteoid tissue. The process advances along the blood vessels and later the new bone becomes thicker and less vascular. The commonest site of disease is the promontory in the region of the anterior margin of the oval window. In an advanced stage the stapes becomes ankylosed in position by a mass of spongy new bone. Julius Lempert in the opening paragraphs of long study to which reference will be made,[1] states that the lesion consists of circumscribed, sharply defined, inlaid bony tumours within the otic capsule and that these lesions have been found during routine histological examination of the temporal bone of persons who were never known to be deafened, within one or more of the following regions of the otic capsule: the oval window, the round window, the cochlear capsule and the fundus of the internal auditory meatus. Lempert explains that whenever the otosclerotic patches in a histological specimen were observed to have remained within the bony capsule of the labyrinth, no clinical signs or symptoms which could have suggested such a lesion were known to have been present during life. When, however, the otosclerotic tumour was observed on histological examination to have proliferated beyond either the periosteal or the endosteal layer of the bony capsule in the region of the oval window and to have caused ankylosis of the stapedial footplate, a history of deafness during life was obtainable. This preliminary statement on the nature of otosclerosis is a necessary antecedent to any discussion on the surgical treatment of the condition. Various theories are advanced to explain the nature of the condition, and though these are of absorbing interest, and may have a bearing on surgical treatment, they cannot be discussed in detail at present. What must be remembered is the fact that the condition is progressive and chronic, that it does not arise from any cause confined to the internal ear and that though surgical measures may give the patient some relief of his deafness, they cannot in any sense be looked on as curative of the condition. At this stage it may perhaps be useful to point out that Lempert refers to the condition as clinical otosclerosis, for he thinks that the term otosclerosis should not be used unless histological proof of the presence of a sclerotic lesion has been obtained.

The improvement of hearing is brought about in surgical treatment by the making of an artificial opening into the labyrinth. I. Simson Hall, in discussing the surgical treatment of otosclerosis at the Royal Society of Medicine in March, 1944,[1] stated that this had been known since Kessel demonstrated it in 1876. The main object since then has been "to replace the immobilized stapes by a movable membrane". Lempert's paper and the discussion at the Royal Society of Medicine show quite clearly that this operation has a limited field of application, that it is not always followed by lasting improvement and that it is not free from the risks that accompany any other major surgical procedure. It is therefore somewhat unfortunate that an abstract of Lempert's paper was published in a popular magazine, for the public is not in a position to form a judgement on such a question and false hopes are likely to be aroused in the minds of sufferers from incurable deafness. If a short conclusion on the subject had to be stated, it would be to the effect that if a careful selection of patients for operation is made and the procedure adopted is one that will stand up to the criticism of experts (of whom there are not many), success will be achieved in a certain proportion of cases, but that even in these improvement in hearing may not last for long periods. Unfortunately also the patients most suited for the operation in question are those most likely to be helped by one of the modern hearing aids. This last fact increases the difficulty of selection and makes the general conclusion sound more forbidding than it would otherwise be. In stating this general conclusion we have perhaps put the cart before the horse, but the views and experiences of Lempert and Simson Hall will, we believe, justify this reversal.

Lempert holds that when a newly created window in the bony capsule of the vestibular labyrinth replaces the functionally impeded oval window and establishes a new air conduction mechanism which permits the perilymph and the endolymph to be freely mobilized again by airborne sound, clinical otosclerosis is converted into symptom-free otosclerosis. Diagnosis is clearly of primary importance. Lempert is at considerable pains to show that the classical signs and symptoms of clinical otosclerosis are not always encountered in patients whose deafness is due to this condition. He describes at some length the masked and obscured clinical pictures that may

[1] *Archives of Otolaryngology*, January, 1945.

[1] *Proceedings of the Royal Society of Medicine*, October, 1944.

be encountered. In this part of his discussion we cannot follow him. Rather should we be concerned with the type of operation that he has evolved. He states that in a period of seven years he has performed fenestration of the labyrinth in 1,000 cases. In the first 300 of these he created the fenestra in the external semicircular canal; in the last 700 the fenestra was made in the surgical dome of the vestibule. When an opening is made into the bony walls of the semicircular canal or the vestibule, osteogenesis naturally occurs and the gap tends to close. Signs and symptoms of the occurrence of osteogenesis in Lempert's experience began to manifest themselves as early as four to six weeks and as late as eight to twelve months after operation. Hearing regained after formation of the opening begins to recede with its closure and ultimately reaches the pre-operative level. Lempert tried various methods to prevent osteogenesis. For example, he tried to damage and alter the normal histological character of the bony walls: by burnishing with a dental burr and with burrs of gold, silver, lead and so on; by plating the bony walls with silver amalgam; by applying the electrocoagulating current to the walls; by X-ray therapy. He tried to remove all fragments of bone and "bone sand". It was with the object of preventing osteogenesis that he transferred his fenestra from the semicircular canal to the vestibule. Here the fenestra could be wider than in the semicircular canal. Here also, because the perilymph space is deeper than in the region of the external semicircular canal, the formation of a fibrous connective tissue matrix for new bone becomes more difficult. Lempert believes that closure has occurred less frequently in the vestibule than in the semicircular canal. He points out that if a fenestra remains permanently open, continuous improvement of hearing is not necessarily maintained. This is because of the occurrence of post-operative labyrinthitis. In order to eliminate this labyrinthitis Lempert tried several expedients. First of all he used prophylactic sulphadiazine therapy and then he experimented by leaving intact the endosteum on the floor of the newly created fenestra. Finally he evolved a method by which he inserted a piece of cartilage into the fenestra. As long as this cartilaginous stopple remains mobile it simulates in function the stapedial footplate. This is the technique that he is now adopting exclusively. We do not propose to quote many of Lempert's figures, except to state that of the 1,000 patients, 75 were operated on more than six years ago. Of these, 24 "have retained their practical, serviceable hearing for more than six years since operation and continue to hear for all social and economic contacts".

At the meeting of the Royal Society of Medicine, Simson Hall described his technique. He said that he had used the roof of the vestibule, as advocated by Lempert, but that "possibly by chance" he had obtained inferior results and had therefore returned to the ampulla. Simson Hall adopts a post-auricular approach and follows very closely the lines of the modified radical mastoid operation in the exposure of the labyrinth. One of the most important parts of his operation is the formation of the "meatal plastic". This is the mobilization of the postero-superior portion of the lining of the external auditory meatus and the *membrana flaccida* in a continuous flap; this flap is used to cover the new opening in the vestibule. The formation of this flap is a critical point in the one-stage operation, because if the flap is torn the operation may have to be abandoned or concluded as a two-stage operation. With the formation of the flap, the exterral meatus is enlarged. When the flap is turned back the contents of the middle ear are visible. The capsule enclosing the heads of the malleus and incus is incised; this frees the incus which can be removed. The head of the malleus is separated from the rest of the bone and the first stage of the operation is complete. For the second stage Simson Hall uses a special operating microscope with a drill and an irrigating and suction apparatus. By means of these shreds of bone are removed and the edges of the fenestra are polished. The flap is spread over the fenestra and secured in position with paraffin packs. Simson Hall has operated on sixty-six patients in six years. Those operated on with his present apparatus number forty-five. Six of the patients have disappeared, and of the remainder, twenty show worthwhile improvement. Of the patients operated on prior to 1940, slightly more than a third have retained their improvement in hearing. In the period of twelve months, eighteen months ago to six months ago, the proportion of those with maintained improvement is two-thirds. Simson Hall holds that we have now reached the stage at which technical advancement has almost ceased, and that the future of the operation depends upon the results of research into the question of bone regeneration. This may be granted, and it is the natural attitude of the operating surgeon. The main question of the causation of otosclerosis, however, remains unanswered, and it is to this that research should be directed.

DECORTICATION IN HÆMOTHORAX.

As a rule conservative measures are held to be the most suitable form of treatment in traumatic hæmothorax, and good results have been reported both when aspiration has been used and when spontaneous absorption has been allowed to occur. H. C. Smithy has pointed out[1] that, no matter what kind of conservative treatment is adopted in newly acquired traumatic hæmothorax, the condition will become chronic in a small percentage of cases and that pleural thickening, fluid loculation and persistent puemothorax will occur. Many surgeons will confirm this statement. Smithy states that in chronic persistent cases which are uninfected, exploratory thoracotomy should be undertaken, all fibrin, clots and fluid should be removed and the wound closed snugly without drainage. In a recent paper N. R. Barrett states[2] that hæmothorax has three immediate harmful effects—blood loss, pleural irritation and the development of a space-occupying lesion in the chest. When the whole of the pleural contents are not absorbed spontaneously, the bloody effusion acts as a retained foreign body and pathological changes continue. Pockets of fluid become separated from each other by partitions of fibrin and organization of the material deposited on the surfaces of the pleura begins. Barrett refers to the commonly held view that many a hæmothorax cannot be aspirated completely without air replacement because of atelectasis. The explanation fits the facts, but is not, he thinks, usually the true one. He believes that the usual reason why the lung will not expand is that it is bound down by an envelope of fibrin, and the deep layer of this membrane is rapidly replaced by fibrous tissue. Fibroblasts, he insists, appear early in the investing layer of fibrin. C. Price Thomas and W. P. Cleland maintain[3] that organization with fibrous tissue formation occurs with great rapidity in a hæmothorax and takes place earlier and is more extensive when clotting occurs. They have found well-developed fibrous tissue on the visceral pleura in hæmothoraces of only two weeks' duration. They found infection in 30% of 526 hæmothoraces and clotting in 9%. They hold that early and complete obliteration of the pleural space is the most important single factor in the prevention of pleural sepsis and its elimination when once established. The views of Thomas and Cleland on operation are worthy of note. They deal specifically with decortication, or removal of the fibrous tissue layer from the visceral pleura. It should be pointed out that when sepsis is present they sterilize the cavity, with penicillin if possible. Decortication in extensive cases must be carried out over the whole lung, and success depends on the rapid and complete reexpansion of the lung with obliteration of the pleural cavity. After trial of several methods to produce obliteration they have had consistent success with the use of suction and a negative pressure of four to six centimetres of mercury. They give details of cases and reproduce radiographs to support their contentions. Price and Cleland's paper should be studied by all who have to do with surgical conditions of the thorax.

[1] *The Journal of Thoracic Surgery*, Volume XII, 1943, page 339.
[2] *The Lancet*, January 27, 1945.
[3] *The Lancet*, March 17, 1945.

Abstracts from Medical Literature.

OPHTHALMOLOGY.

Diathermy in Glaucoma.

D. GUERRY (*American Journal of Ophthalmology*, December, 1944) carried out experiments on rabbits to determine the pressure in eyes in which the long ciliary vessels and then the ciliary region were subjected to diathermy. He finds that when one vessel only is occluded the pressure falls and returns to normal after a few days. When both long ciliary arteries are blocked the eye develops a state of *phthisis bulbi*. In man the long ciliary artery on the nasal side lies under the internal rectus and can easily be identified entering the sclera about the equator. On the temporal side it may enter the globe far back even at the insertion of the inferior oblique muscle. When one artery is blocked, as in the rabbit, the pressure falls for a few days. This has two important bearings: (i) In cyclodiathermy there is an initial rise of pressure which may aggravate existing glaucoma. If the long ciliary artery is blocked at the same operation this does not occur. (ii) In cases of retinal detachment when hypotony is to be avoided it is wise to steer clear of the horizontal meridian in case the long ciliary arteries are accidentally coagulated.

Torn Lachrymal Canaliculus.

M. D. CAMPBELL (*Air Surgeon's Bulletin*, December, 1944) reports a method of suturing a severed canaliculus. The punctum is dilated and a curved needle threaded with thick black silk is passed through to the wound, eye end foremost. To locate the other end of the canaliculus, mercurochrome solution is syringed into the superior canaliculus; it fills the sac, and escapes through the wound. The proximal end located, the needle and silk are passed into the sac, out through the skin and cut short. The wound is then sutured around the silk just as a ruptured urethra may be sutured round a catheter. As the wound heals the silk is very gradually withdrawn through the punctum until finally probing is instituted.

Non-Magnetic Foreign Bodies.

H. E. THORPE (*The Journal of the American Medical Association*, January 27, 1945) describes new methods of dealing with non-magnetic intraocular foreign bodies. A sliver of brass or wood lying between the corneal lamellæ may be extracted with special splinter forceps. Fragments in the pupil area of the cornea are best handled by the Kuhnt technique. A narrow-bladed keratome is passed across the anterior chamber to protect the lens, the pupil being contracted with eserine. The foreign body is then extracted with knife, needle and forceps. The angle of the anterior chamber may be reached with a keratome, Graefe knife or trephine and the foreign body teased clear with a blunt iris hook or forceps, after which the wound is closed with a corneo-scleral suture. A foreign body in the lens may sometimes be extracted by the insertion of a gauge 19 hypodermic needle through a small keratome incision and suction. In the posterior aqueous chamber a sclerotomy incision is made, iridodialysis is performed and the iris is held out of the way with a hook. The foreign body is usually embedded in exudate. In the ciliary body a radial incision is made and the lips of the wound are held apart by sutures. For hæmostasis it is useful to place a drop of thromboplastin or 1 in 100 adrenaline solution in the wound. Localization is aided by a powerful transilluminator placed on the opposite side of the globe. In operations on the vitreous one of three techniques may be employed: (*a*) the use of the ophthalmoscope and forceps, (*b*) the use of transillumination, ophthalmoscope and forceps, and (*c*) endoscopy. The author has had constructed an ophthalmic endoscope. It is very similar to a minute operating cystoscope and works on the same principle. In cross section the working end of the instrument measures 6·5 by 2·5 millimetres. It is particularly useful when the lens is opaque and a foreign body has been localized in the vitreous by X-ray examination. The field of view is 60° of arc and all objects from 0 to 25 millimetres are in focus. Various forceps ends are supplied. In manipulation an incision is made down to, but not into, the vitreous. A search is then made and the forceps are pushed into the vitreous to grip the foreign body. In this way a minimum of vitreous is lost. Sutures and a ring of diathermy points are used to close the wound.

History of Refraction.

W. H. CRISP (*American Journal of Ophthalmology*, January, 1945) reviews some of the steps which led to our modern knowledge of refraction. It is probable that the first type of refractive error to be subjected to anything like systematic correction was myopia. In 1629 Charles I granted a charter to the Worshipful Company of Spectacle Makers. Benjamin Franklin is said to have designed in 1777 the first pair of bifocal spectacles. For a long time the terms "presbyopia" and "farsightedness" were used synonymously. Knowledge of astigmatism is comparatively recent. Thomas Young (1800) described an astigmatism in his own eye, clear vision for horizontal rays being three-tenths of an inch closer than that for vertical rays. Little practical benefit followed this description, but twenty-seven years later Airey, the Astronomer Royal, observed that the image rings of a star were not circular, but elliptical. After experiment with lines at right angles the first cylindrical lens was ground to correct this error. The greatest advance in the measurement of refraction will be forever associated with the name of Donders, who published his work at Utrecht in 1860. Since then differences of opinion and changes in technique have developed, but the essentials have not altered. Even biastigmatism or the occurrence of distinct and usually conflicting astigmatisms in the cornea and lens of the same eye was clearly referred to. His work was timely. For twenty-five years the standard English text-book on the subject had declared most cases of asthenopia to be incurable and had recommended manual work or migration as the best solution. Three other great advances followed. Snellew proposed the use of standard type at six metres, instead of varying the distance of the type from the patient, as had been customary. Fogging and then atropine were introduced to unmask latent hyperopia. Helmholtz introduced the ophthalmoscope, and in 1875 Cuignet first described the uses of retinoscopy. Jackson in America and Maddox in England made contributions to the use of ophthalmometers and cross cylinders about 1900. Refinements, but no great changes, have occurred since.

Extraction of Senile Cataract.

W. F. HUGHES, JUNIOR, AND W. C. OWENS (*American Journal of Ophthalmology*, January, 1945) present a "pilgrim's progress" in cataract extraction over the last nineteen years. At the Wilmer Institute where they worked, approximately 2,000 patients suffering from uncomplicated cataract were operated on during this period. The original technique was combined extracapsular extraction with iridectomy and without sutures. After the authors had operated in 373 cases they began to suture the conjunctiva, to prevent the wound from opening. They did this 266 times with little if any improvement. The next change was radical. They used the intracapsular technique with iridectomy and conjunctival sutures (207 cases); they then substituted corneo-scleral sutures (424 cases) and to date have removed the lens complete with capsule through a round pupil in 380 cases. All of the usual complications, loss of vitreous, incomplete closure of the wound, prolapse of the iris, hæmorrhage in the anterior chamber, iridocyclitis, secondary glaucoma and detachment of the retina occurred in varying percentages in each series. Loss of vitreous was greater in the intracapsular series, but diminished with the authors' experience. Incomplete closure of the wound became a rarity after the corneo-scleral sutures were introduced and the incidence of prolapse of the iris fell from 6·8% to 1·3%. Hæmorrhage in the anterior chamber was halved when no iridectomy was done. Iritis and secondary glaucoma which were common when lens matter was left to absorb, occurred in only 1·5% when the lens was removed entirely. Visual end results improved as well. Debris in the pupil, common earlier, became notably absent in the intracapsular series. The use of sutures reduced the percentage of high astigmatisms from 16·2% to 0·6%. Visual acuity improved at every stage: 65% of patients obtained a vision of ⅔ or better with the old method; 91% achieved it with the new. Most of the lenses were extracted by tumbling with capsule forceps. In one series 37% of capsules ruptured during delivery; in another 19%. The suction cup was used later for hypermature lenses. Vitreous opacities were found to result, not from loss of vitreous alone, but only when this was combined with hæmorrhage or cortical remains. Slight loss of vitreous causes less trouble than retained lens remnants. Hence, every attempt should be made to wash out any remaining cortex, but capsule should be left alone if there is any risk of rupturing the hyaline membrane. Preservation of a round pupil reduces the risk, not only of vitreous loss, but of prolapse, hæmorrhage and infection. The moral of all this is

obvious. If, at the end of a cataract operation, the wound is left open, the iris is cut and the anterior chamber contains lens debris, the end results will not be nearly so good as when the wound is sutured, the iris is undamaged and the lens has been removed entire.

Alkali Burns.

L. W. OAKS (*American Journal of Ophthalmology*, April, 1945) states that it has been known for some time that when ammonia is splashed into an eye it rapidly penetrates the cornea and forms a high concentration in the aqueous. The destructive effects of the poison on intraocular tissues can be prevented only by immediate and repeated paracentesis. Many eyes have been saved by this procedure. It appears not unlikely that other powerful chemicals may act upon the eye in similar fashion. The author lists three cases, two burns caused by lime and one caused by beechwood creosote. In each case the anterior chamber was opened at once and escaping aqueous was found to be opalescent and under abnormal pressure. Daily drainage was carried out by depressing the lower lip of the wound. After several tappings the aqueous became clear and the damage to the cornea was much less than had been expected. There was no eventual damage to the iris.

OTO-RHINO-LARYNGOLOGY.

The Preepiglottic Space and its Relation to Carcinoma of the Epiglottis.

LEWIS H. CLERF (*Archives of Otolaryngology*, September, 1944) describes the lower half of the epiglottis and the anterior extremity of a ventricular band as the second most common site of laryngeal cancer. From this area the growth is prone to invade the tissues anteriorly. Recurrence of cancer in the region of the hyoid bone following laryngectomy is thus explained. The preepiglottic space is devoid of any effective limiting barrier on its posterior aspect. The space itself comprises a triangular area with its base directed upwards. It is an actual space filled with cellular and adipose tissue. It contains no lymph nodes, but is traversed by lymphatic vessels. Anteriorly the upper part of the thyreoid cartilage and the thyreohyoid membrane form a limiting barrier, while the hyo-epiglottic aponeurosis or ligament, which extends from the hyoid bone to the epiglottis, and which forms the bottom of the vallecula, is also resistant to cancer spread. The weak wall of the triangular space is posteriorly where the thin epiglottic stem affords little protection. Lymphatic vessels may carry cancer cells from the epiglottic base and vestibule to two small nodes on the mylohyoid muscle above the hyoid bone, to a node situated below the posterior belly of the digastric muscle, and to the upper deep cervical group of lymph nodes. Perforation of cancer into the preepiglottic space commonly occurs early, even before it is recognized clinically. It is necessary therefore to deal surgically with this space. Since spread upwards above the hyo-epiglottic aponeurosis is rarely observed, a surgical approach which does not enter the preepiglottic space should be employed. The space, however, should be included in the excision. To this end the hyoid bone is removed along with the larynx, by incision through the muscles above the bone and subsequent dissection above the hyo-epiglottic aponeurosis.

The Use of Radon to Prevent Otitis Media due to Hyperplasia of Lymphoid Tissue and Barotrauma (Aero-Otitis).

E. P. FOWLER, JUNIOR (*Archives of Otolaryngology*, November, 1944), states that American soldiers in England have been prone to *otitis media* associated with hyperplasia of pharyngeal lymphoid tissue. In one hospital 0·8% of ground personnel and 22% of flying personnel had a history of recent *otitis media*. Nearly all had sufficient excess lymphoid tissue around their Eustachian tubes to account for this. Applicators carrying 75 millicuries of radon in a capsule of platinum 15·0 millimetres by 3·5 millimetres and with walls 0·65 millimetres thick were employed to treat 220 patients. One applicator is passed through each nostril to reach the vicinity of the torus of the Eustachian tube. From the two capsules it is estimated that approximately the equivalent of 66 milligramme hours of radium dosage is given to the nasopharyngeal walls. In some cases a dose of 100 milligramme hours was given. Treatments were given at intervals of four to six weeks until four to six applications had been made. There was rarely any evidence of improvement until after the third treatment. Of airmen who had had two or more episodes of severe difficulty in clearing the ears, 79% were, following treatment, symptom free after two months of flying. Many of these airmen had previously reported aero-otitis after every flight. Of ground staff, previously prone to recurrent *otitis media*, suppurative and non-suppurative, 75% had remained free of attacks after a four months' interval.

Malignant Tumours of the Nasal Cavity.

F. Z. HAVENS AND W. C. THORNELL (*Archives of Otolaryngology*, November, 1944) lay stress on the frequency with which unilateral nasal obstruction is found to be due to malignant growth, especially in patients over forty years of age. Nose bleeding and a tendency for free bleeding to follow slight trauma of the tumour are further causes for suspicion. The appearance may often be that of simple nasal polypi, so that routine biopsy of portions of such structures should be carried out. A combined form of treatment, in which surgery and radium were used, was successful in all of a series of eight cases. Wide access to the ethmoid region and nasal cavity was obtained through a curved incision extending from the eyebrow to the lower edge of the nasal bone. The nasal bone is then snipped away, a start being made at its lower edge; then the frontal process of the maxilla, lachrymal bone and ethmoid may be excised, as it is necessary to secure a clear conception of the extent of attachment of the tumour. Only as a result of this wide approach could it be observed that, very often, though the tumour was large, its attachments were small and removal of the mass was readily achieved. The points of attachment were then treated with electrocoagulation and finally radium was applied to the site.

Treatment of Inoperable Cancer of the Throat.

M. F. ARBUCKLE, A. C. STUTSMAN AND SHERWOOD MOORE (*Annals of Otology, Rhinology and Laryngology*, December, 1944) state that, irradiation being the only method of treatment available in most advanced cancers of the throat, they have worked out a plan to avoid the disastrous consequences of X-ray injury to the thyreoid cartilage, in order that intensive and appropriately directed radiation therapy may be given, for it has been found that with sufficient dosage to kill cancer cells, X-ray injury to the cartilage is most likely to occur. Having learned that the laryngeal functions were not materially impaired by total removal of the thyreoid cartilages, the authors decided to excise the cartilages *in toto* before beginning irradiation. This is effected through a mid-line incision extending from the hyoid bone to the fourth tracheal ring. A tracheotomy is performed through the third and fourth rings. The thyreoid cartilages are divided in the mid-line, care being taken to avoid injury to the inner perichondrium. The perichondrium is then elevated off the inner and outer surfaces of the cartilaginous mass which is then lifted out. The wound is closed in layers. Feeding is carried on through a nasal tube during healing. Sixteen patients suffering from inoperable cancer have been treated by intensive irradiation after cartilage resection. Eight are living and free of signs of cancer. All of these have normal deglutition and a good voice. Nearly all have a normal airway, but wear a small tracheotomy tube which they keep plugged. Only occasionally was there evidence of reaction in the epiglottic cartilage, but this has always subsided, so that it is not considered necessary to remove that cartilage. Injury to the cricoid cartilage during operation may render that structure more prone to subsequent necrosis, so that such accidental trauma should be carefully avoided.

The Use of Zinc Peroxide in Otology.

COLIN M. JOHNSTON (*The Journal of Laryngology and Otology*, May, 1944) states that a 10% oily emulsion of zinc peroxide was found to be suitable for application on ribbon gauze in the ear or mastoid cavity. Success is reported in the treatment of *otitis externa* with this preparation, the meatus being tightly packed every day or on alternate days. After two to four days the meatus was found to be widely dilated. If treatment was omitted at this stage, however, œdema often rapidly returned, so that process was usually continued for seven to ten days. No patient complained of discomfort due to the packing, while pain, previously present, was usually relieved. In no case was any skin irritation observed as a result of the procedure. Where packing of a mastoid cavity was required, the same emulsion on gauze tape was found to be very effective, often serving as a soothing substitute where iodoform gauze had caused dermatitis.

British Medical Association News.

SCIENTIFIC.

A MEETING of the Section of Neurology, Psychiatry and Neurosurgery of the New South Wales Branch of the British Medical Association was held on April 19, 1945, at the New Medical School, University of Sydney.

Torulosis Involving the Brain and its Membranes.

DR. R. D. ROTHFIELD showed specimens from a case of torulosis involving the brain, meninges and other organs. The patient, a man, aged fifty-nine years, had suffered for three weeks prior to his admission to hospital from stiffness in the back of the neck. His behaviour and speech subsequently became irrational, and he suffered from progressively more severe frontal and occipital headache. He also experienced "turns", in which he felt giddy, without actually falling. A week before his admission to hospital he caught a cold, which was followed by tinnitus and deafness. He did not vomit, and his vision was not blurred. His previous record contained no relevant incidents. He was a railwayman, and had worked mainly in the country; he was not known to have done any farming.

On his admission to hospital, his temperature was normal. The plantar response was extensor on both sides, but no other abnormality of the reflex, motor or sensory functions was observed. There were small defects in the visual fields, but the ocular fundi appeared normal. No abnormality was recorded in any other system. Examination of the blood revealed 35,000 leucocytes per cubic millimetre, of which 93% were neutrophile cells; the hæmoglobin value was 10 grammes per 100 cubic centimetres. The serum failed to react to the Wassermann test. The cerebro-spinal fluid was clear, and under a pressure of 220 millimetres; it contained 40 milligrammes of total protein per 100 cubic centimetres, the globulin content being increased; the chloride content was 650 milligrammes per 100 cubic centimetres; the fluid contained 105 cells per cubic millimetre, 95% being lymphocytes. The Wassermann test failed to produce a reaction. The cerebro-spinal fluid was not culturally examined.

A skiagram of the chest revealed in the upper lobes of both lungs changes regarded as tuberculous, and at the base of the right lung an effusion and pleural thickening. Repeated examination of the sputum failed, however, to reveal tubercle bacilli; various bacteria were present, but no torulæ.

The patient's condition gradually deteriorated, with nightly pyrexia, rapid wasting and mental confusion. Sulphadiazine was given without effect. The patient was regarded as suffering from pulmonary tuberculosis and tuberculous meningitis. He was transferred to a ward for tuberculous patients, where he died six weeks after his admission to hospital.

At autopsy, the lower lobe of the right lung was found to contain a well-defined, tumour-like mass, ten centimetres in diameter. It was roughly spheroidal, and felt firm and indurated; it had undergone no gelatinous or mucoid change. The superficial portion of this lobe contained an abscess communicating with the pleural cavity, and forming an empyema, with creamy, odourless pus; both here and at the apex pleural adhesions were present. In the upper lobes of both lungs fibrosis but no caseation was found. The pericardium contained a few flakes of purulent exudate close to the great veins. The left side of the thoracic wall contained an abscess in the subcutaneous fat, not communicating with either the pleural cavity or the exterior. In the brain there were many small softened areas resembling abscesses. These were most numerous in the hemispheres, where they occurred in both the grey and the white matter; one of the largest, measuring 1·0 centimetre in diameter, was situated in the right *crus cerebri* at the upper pontine level. There was no gross meningeal exudate. The left adrenal gland was replaced by an abscess of unusual appearance, somewhat loculated, and extending into the surrounding tissues. The spleen was a little enlarged and soft, but in the other organs no relevant abnormality was detected.

The mass in the right lung was thought to be a carcinoma, which was associated with septic infection of the lung and pleural cavity, and with pyæmic embolism in the brain, thoracic wall, and left adrenal gland. The empyema contained hæmolytic streptococci and other bacteria, but no yeast cells.

Histological examination of the tumour-like mass revealed large numbers of rounded yeast-like bodies, considered to be torulæ. These were Gram-positive; each contained a small nuclear dot, and was surrounded by a refractile capsular zone with the same staining properties as mucin. In the upper lobe of the lung were found typical silicotic nodules, and small pyogenic abscesses, close to which torulæ were demonstrated. Similar parasites were present in the pia-arachnoid, associated with a lymphocytic exudate. The softened areas within the brain were affected by aseptic necrosis, and contained torulæ, which were also detected close to the adjacent blood vessels. The abscess in the left adrenal gland was of subacute pyogenic type, but in it no parasites were demonstrated with certainty. As no cultural examination was attempted, no exact classification of the yeast could be made; it resembled *Torula histolytica*, but the histological preparations nowhere showed the typical gowth by "budding".

Dr. Rothfield pointed out the characteristic involvement of the lungs and the central nervous system, and the association of torulosis with other forms of pulmonary disease—more often tuberculosis, but in this case silicosis. The parasite was thought to enter the blood stream from the pulmonary lesion, and an attempt at culture from the blood might have been of diagnostic value. In retrospect, a striking clinical feature was the repeated failure to find tubercle bacilli in the sputum, in the presence of gross radiological abnormalities; this cast doubt on the desirability of segregating such a patient with patients suffering from tuberculosis. The reduced chloride content of the cerebro-spinal fluid (650 milligrammes per 100 cubic centimetres) was regarded as confirming the diagnosis of tuberculous meningitis, but such a reduction was not infrequent in meningeal torulosis.

Cerebral Softening Associated with Dissecting Aneurysm of the Aorta and Healed Myocardial Infarct.

DR. J. S. ROBERTSON demonstrated preparations from a male patient, aged fifty-three years. Eight months prior to his death he had had a "stroke", which left him with blurred speech and a partial paralysis of one side of the face. Five days before death, while leaning forward, he suffered a sudden severe pain in the precordium and epigastrium, accompanied by cold sweating and collapse. He was put to bed, but next day, when left alone for a few minutes, he was found by his attendant out of bed and unconscious in a chair. He was pale, sweating profusely and breathing heavily. He was unconscious for thirty minutes, and when consciousness was regained it was found that a right hemiplegia accompanied by aphasia was present. During the following two days the aphasia persisted, but there was some recovery of movement in the right leg. At this stage he was admitted to hospital.

Physical examination showed that he could respond slowly to commands, that he could understand the spoken word, but that he was unable to speak. There was a motor paralysis of the right lower portion of the face, the right arm and the right leg; increased tonus and an extensor plantar response were noted on the right side. The pulse rate was 110 per minute, and occasional beats were dropped. The heart was not enlarged on clinical examination, and the blood pressure was 120 millimetres of mercury (systolic) and 90 millimetres (diastolic).

On the day after his admission to hospital the patient became restless in the evening, sat up in bed trying to speak, and died shortly afterwards.

At autopsy, examination of the brain revealed, in the left cerebral hemisphere, and affecting the cortex in the region of the lower parts of the left anterior central gyrus and the inferior frontal gyrus, a swollen area over which the leptomeninges were thickened and infiltrated with blood, and in the grey matter an area of recent red cortical softening was observed. Many small petechial hæmorrhages were present in the grey matter in this region, but in the underlying white matter only one small patch of recent softening was found, although there were, at a slightly greater depth in the white matter, two small old areas of cystic softening. The basal vessels were of moderate calibre, and affected by some atheromatous changes. In the left middle cerebral artery, at a point just beyond the origins of the central perforating branches, there was a short length where atheromatous change was extreme, with great diminution of the lumen.

In the heart and great vessels remarkable changes were found. At the apex, and extending up the posterior wall of the left ventricle, was an old hyaline healed infarct. No yielding of the ventricular wall had occurred. Originating in a linear tear one centimetre in length, at a point on the anterior aspect of the aorta four centimetres above the aortic valve, a large dissecting aneurysm had formed.

stripping up the media of the arch of the aorta, and also infiltrating into the fascial planes of the superior portion of the mediastinum, and into the pericardium. In this last situation there was evidence of early organization. When the aorta was stained for elastic tissue, a diffuse deficiency of the elastic substance was detected.

Dr. Robertson said that this patient had had an unlucky series of vascular accidents. It was unfortunate that no date could be given to the occurrence of the myocardial infarct, but it was apparently of considerable age. At the time of occurrence of the severe pain in the chest, five days before death, the dissecting aneurysm had apparently commenced to form. This lesion, although extensive, had not been the cause of death. In fact, there was evidence of attempted healing in the pericardial portion of the effusion. The day after this accident, however, the cerebral softening had occurred, and it was this lesion which had caused the ultimate fatal issue. Dr. Robertson considered the case of interest as illustrating both an unusual combination of lesions, and the fact that vascular accidents were sometimes prone to be multiple in the same patient.

Visceral Lesions and Tuberous Sclerosis of the Brain.

PROFESSOR KEITH INGLIS briefly discussed visceral lesions associated with tuberous sclerosis of the brain. He showed histological preparations in support of his opinion that the fatty tumours that occurred in the kidneys of some such patients had a neuromatous basis.

DR. OLIVER LATHAM said that excellently retrieved and fixed brains had been received by him, accompanied by a truly exciting and acute clinical history, in which he had been unable with his microscope to find any worthwhile neuropathological lesions. He had no doubt but that his hearers had been as disappointed as he. He proposed to exhibit specimens containing lesions disclosed with clarity only by some metallic impregnation. Dr. Latham began by showing two recently received brains, both from subjects who had exhibited grave clinical mental phenomena, and in neither of which were the usual microscopic preparations able to reveal any abnormality.

The first microscope slides were from the brain of a girl, aged fourteen years, just recovered from mumps, who had developed grave pulmonary œdema from which she succumbed, but not before severe brain symptoms had intervened. Examination of a parotid gland section had revealed complete cessation of specific mumps reaction—a finding commonly implying that a mumps infection was not to be thought of in the ætiology of further grave phenomena. Examination of the lung sections suggested virus pneumonia, at least an acute interstitial reaction, and the application to frozen sections of brain and stem of the Penfield-Cone modification of Hortega's silver method (unlike the latter, quite easy to apply) revealed a remarkable activation of the microglia in most of the sections. The clear proliferation and magnification of these elements offered undoubted evidence of an early and widespread acute encephalitis.

Dr. Latham's next specimen was from a lad of nineteen years suffering from tetanus, whose cerebral irritation was extreme and required the exhibition of "Avertin". In this instance, too, the activation of the microglia was outstanding and conspicuous, denoting an actual encephalitis, if in part only toxic.

Dr. Latham next showed cortical brain sections from a subject of general paralysis. In these the more chronic encephalitis was accompanied by the development of enormously long rod cells and also by the presence of *Gitterzellen*, likewise derivatives of the microglia.

Some frozen cortical sections prepared according to von Braunmuhl's silver method revealed not only the argyrophile plaques in a case of Alzheimer's disease, but also the coarsening and fusing together of the intracellular neurofibrils as well as the newly formed (and older) mesenchyme in the blood vessels. It was pointed out that newly formed mesenchyme took nearly fourteen days to develop to a condition in which it could be stained by eosin or van Gieson's stain, whereas in a day or so the newly laid down mesenchyme would take on silver somewhat like intercellular substance. The method also showed well the degenerated cortical neurones with twisted atrophied processes. The Rogers-Foot silver methods sometimes with luck demonstrated similar pictures with paraffin sections. Dr. Latham also said that Cajal's silver method revealed, if over-reduced, the activation and hypertrophy of the molecular and deep glial cell hypertrophy in general paralysis. In the next section were shown great bands of activated microglial cells round a tumour near the pineal gland.

Dr. Latham then showed sections of the cerebellar cortex prepared by these methods. Not only were the Purkinje and basket cell neurones readily demonstrated, but also the hypertrophied Bougman glia and the glial fibres from the surface. Dr. Latham pointed out also the swellings on the Purkinje axons called torpedoes and certain upcurved fibres resembling their collaterals, structures constantly alluded to by Gordon Holmes. Dr. Latham said that these methods proved invaluable in the investigation of certain cases of cerebellar disease, as well as in attempts to resolve small collections of cells around capillaries particularly well demonstrable in the olives from subjects of typhus fever. The small cell collections seemed more of the nature of adventitial cells, and but few were microglia. It had to be admitted that similar small structures could be seen in many varieties of encephalitis, syphilis, puerperal sepsis, "X" disease and even certain forms of arteriosclerosis. Finally these methods resolved the cells in pineal tumours. The application of these methods as well as the Mallory stains to the peculiar cellular proliferations occurring in the cerebral and cerebellar white matter in Weston Hurst's acute leucoencephalitis was then demonstrated.

Medical Societies.

MELBOURNE PÆDIATRIC SOCIETY.

A MEETING of the Melbourne Pædiatric Society was held on November 8, 1944, at the Children's Hospital, Carlton, Melbourne, DR. ALAN MCCUTCHEON, the President, in the chair. Part of this report was published in the issue of June 9, 1945.

Intestinal Obstruction.

DR. J. G. WHITAKER showed three children on whom he had operated for intestinal obstruction. The first was a girl, aged two years and eight months, who had been admitted to hospital on June 28, 1944, suffering from abdominal colic of unknown origin. She had had intermittent attacks of constipation and hiccups for some months before her admission to hospital. An excretion pyelogram revealed a double ureter and pelvo-calycine system on the left side. The urine was clear on macroscopic examination. An X-ray examination after a barium meal eight days after her admission to hospital revealed an unusual barium pattern of the jejunal coils suggestive of intraluminal tumours, such as polypi; there was no delay in the passage of barium. Eleven days after her admission to hospital further attacks of colic and screaming occurred. The patient passed blood rectally and vomited on two occasions. On examination, a mass was present in the left hypochondrium. At operation a small bowel intussusception was found and reduced. Several intraluminal polypi were palpated at the site of the intussusception. The child experienced a stormy convalescence during the next few days in spite of blood transfusions and other restoratives. Fifteen days after her admission to hospital (four days after the initial operation) an epigastric mass was palpated. Operation was again undertaken. The intussusception had recurred and was approximately two feet in length. It was reduced easily. Six to eight inches of bowel containing the polypi were resected and a side-to-side anastomosis was performed. The portion of bowel containing polypi, which had been exhibited at the last meeting of the society, was examined microscopically; a generally villous or polypoidal arrangement and adenomatous structure were found. Post-operative measures included the intravenous administration of "Dagenan", continuous gastric lavage and the use of "Anacardone". The child's condition was precarious for some time, but after a stormy convalescence she was discharged home on October 7, twenty-two days after the second operation.

Dr. Whitaker's second patient was a boy, aged thirteen years, who had been admitted to hospital on September 22, 1944. Ten and a half months previously a hydatid cyst had been removed from the pelvis. Eight months after this a hydatid cyst had been removed from the right lung after the diagnosis had been confirmed by X-ray evidence. During the weeks preceding his admission to hospital the child suffered intermittent hypogastric pains and vomiting. The pain became more severe the night before his admission to hospital. On examination, he had a distended abdomen, and shifting dulness was present in the flanks. Tenderness only was found on rectal examination. Operation was performed on the day of his admission to hospital. The terminal portion

of the ileum and the caecum were bound down in the pelvis within a large abscess cavity. A side-to-side anastomosis from the ileum to the sigmoid colon was performed and the pelvic abscess was drained. Convalescence was uneventful except for primary wound hæmorrhage. The patient was discharged to the after-care department, eighteen days after his admission to hospital.

Dr. Whitaker's third patient was a boy, aged three and a half years, who had been admitted to hospital on September 23, 1944. He had had no previous illness. The history was one of intermittent pain in the right iliac fossa and vomiting of three days' duration, but the child had not seemed very ill. On September 23 his mother noticed that the child's abdomen was hard and distended and tender in the right lower quadrant. The bowels had opened each day. His appetite had been poor.

On his admission to hospital, examination revealed a well-nourished, big child, drowsy, and vomiting at intervals. He appeared very toxæmic. The temperature was 102·6° F. and the pulse rate 100 per minute. The heart, lungs and throat were clinically clear. The abdomen was distended and hard; rigidity and tenderness were present all over the lower part of the abdomen. No abnormal mass or viscus was palpable. On September 23 laparotomy was performed through a right paramedian incision. Generalized peritonitis was present, and the small gut was grossly dilated. An acutely inflamed appendix, which was not gangrenous or perforated, was removed. Culture of the pus yielded a growth of *Bacillus coli communis* and *Staphylococcus aureus*. He was given 20,000 units of penicillin in eight cubic centimetres of saline solution intraperitoneally. The abdomen was closed, and two drain tubes into the peritoneal cavity were left. Post-operative treatment consisted of hypodermic injections of morphine ($^1/_{24}$ grain every four hours), the continuous intravenous administration of glucose and saline solution, the intravenous administration of penicillin (10,000 units every three hours), half-hourly aspirations of the stomach and injection of three ounces of glucose and saline solution into the stomach by a Rehfuss tube. On September 24 his condition was poor. Much distension was present, especially in the upper part of the abdomen. A rectal tube was passed, and fluid fæces and flatus were returned. The next day slight improvement occurred, but the abdomen was still hard and distended. The following day he passed several relaxed stools. He had not vomited. His fluid balance was good. Very little drainage had occurred and the tubes were shortened. On September 28 the drainage tubes and the Rehfuss tube were removed. He was taking fluids well orally. The abdomen was soft, though distended. The intravenous administration of glucose and saline solution was discontinued at this stage. On September 30 the upper sutures were removed from the wound. There was a profuse discharge through the lower end of the wound. On October 2 all sutures were removed. The wound was still discharging profusely. On October 4 the administration of penicillin was discontinued; he had received a total of 665,000 units. His general condition was fair. On October 6 he had a loose cough. His wound was discharging profusely and his temperature was still swinging. A course of "M & B 760" therapy was begun. The next day a large pelvic abscess was palpable suprapubically and rectally. The child was vomiting again, and the abdomen was distended. Aspiration of the stomach at half-hourly intervals was resumed, and he was given three ounces of glucose and saline solution by the Rehfuss tube every half hour. The next day he was listless and miserable; the temperature was swinging between 101° and 103° F. On October 9 the pelvic abscess discharged through the wound. The next day his condition was much improved. He was vomiting and was taking a light diet. The wound was discharging profusely and the temperature was subsiding. On October 14 "M & B 760" treatment was discontinued. On October 17 he was well and the wound was almost healed, and on October 19 the child was taken home.

He was readmitted to hospital the same day. He had vomited several times at home and distension had appeared again. On examination, he was flushed and miserable. The temperature was 100° F. He had a fine scarlatiniform rash on the back, shoulders and arms, the throat was reddened, the abdomen was soft and the epigastrium was distended. The wound was bulging. The next day the rash had disappeared. The abdomen was distended but soft. He was not vomiting, but he appeared dehydrated. The intravenous administration of glucose and saline solution was recommenced. On October 21 he was not vomiting, though the bowels had not opened. He was given an enema with a small return. At this stage an X-ray examination after a barium meal was carried out; the findings suggested intestinal obstruction, but there was no localizing evidence. At night he commenced vomiting dark fæcal material. The stomach was aspirated at intervals of half an hour. The next day the abdomen was much more distended and fæcal vomiting persisted. There was no return when a tube was inserted into the rectum. Laparotomy was performed through the old incision. Double ileostomy was carried out. During the operation the child collapsed. Four interrupted through-and-through silk sutures were used to close the wound, and the child was returned to the ward in a moribund condition. Oxygen was continuously administered intranasally, and other restorative measures included the intravenous administration of glucose and saline solution, the intravenous administration of "Neo-Synephrin" (three minims every hour), the intravenous administration of 20,000 units of penicillin every three hours, the exhibition of morphine ($^1/_{30}$ grain every four hours), and half-hourly aspirations of the stomach along with injections of three ounces of glucose and saline solution. The following day he was still moribund. As the hæmoglobin value was only 55%, he was given a transfusion of two pints of blood. He was fed orally with a condensed milk mixture and glucose fruit drinks. A paronychia of the index finger of the right hand was incised at this stage. The abdomen was hard and distended. On October 24 his general condition was slightly improved. The abdomen was distended and tense. Little material had drained from the ileostomy tubes. Digital examination *per rectum* revealed little fæcal material. Three ounces of a 25% solution of magnesium sulphate were inserted into each ileostomy tube. That night the child passed several relaxed stools, and profuse drainage occurred through the ileostomy tubes. The abdominal distension disappeared. The next day the child was much better; he pulled out the ileostomy tubes. The following day there was fair drainage through the wound. He was eating well and the bowels were regularly open. On October 28 the sutures were removed and the wound was strapped. On November 2 penicillin treatment was discontinued after a total of 1,170,000 units had been administered. On November 5 secondary suture of the wound was carried out. At the time of the meeting the child's condition was still satisfactory.

Dr. Whitaker said that he was impressed by the value of ileostomy, even when the obstruction could not be relieved surgically. This was well exemplified in the third case, in which little hope of recovery was entertained; but on the patient's return to the ward his bowels had opened and he had recovered.

DR. ROBERT SOUTHBY congratulated Dr. Whitaker on his successes; he said that the cases were an interesting series. Dr. Southby was particularly interested in the first case, that of intussusception; he had recommended the patient's admission to hospital. The outstanding features of her illness were recurrent attacks of severe colicky pain, which usually subsided by the time medical attention was available. Dr. Southby said that he had seen the child once after an attack. She was free from pain and appeared to be well. He had observed red cells in her urine and suspected a renal origin for her complaint. He recalled another child, in whom he had been interested six years earlier, who had red cells in the urine and a similar history. Dr. Southby asked Dr. Whitaker whether he had had experience of red cells in the urine of older children suffering from intussusception.

Dr. Whitaker, in reply, said that the patient in question had been investigated from the renal standpoint and indeed was discovered to have a double ureter on one side. This might have contributed to the urinary findings. Dr. Whitaker stressed the value of ileostomy for patients who appeared to be going downhill. Ileo-sigmoid anastomosis was a valuable procedure if the patient's condition warranted it.

(To be continued.)

Post-Graduate Work.

THE NEW SOUTH WALES POST-GRADUATE COMMITTEE IN MEDICINE.

SPECIAL ANNOUNCEMENT.

THE New South Wales Post-Graduate Committee in Medicine announces that it has instituted an annual course of a general nature, which began on July 1, 1945, and will

include the present series of winter lectures, a series of lectures to be given shortly by Professor F. M. Burnet, occasional lectures of a similar nature which will be arranged from time to time, and attendance at the regular monthly film afternoons. The fee for the course will be £1 1s. *per annum*, except for members of our own, British and allied services, who are invited to attend free of charge. The yearly periods will be from July 1 to June 30.

The Post-Graduate Committee has also begun publication of a monthly *Bulletin*, which comprises lectures given under its auspices. The subscription is £1 1s. *per annum*, but for members of our own, British and allied services and for those who have enrolled in the annual course, it will be 10s. 6d. *per annum*.

All inquiries, applications, fees and subscriptions should be addressed to the Secretary of the Post-Graduate Committee in Medicine, 131, Macquarie Street, Sydney. Telephone B 4606.

WEEK-END COURSE AT LISMORE.

The New South Wales Post-Graduate Committee in Medicine announces that, in conjunction with the North-Eastern Medical Association, it will hold a week-end course at Lismore, on Saturday, August 4, and Sunday, August 5, 1945.

The programme is as follows:

Saturday, August 4.

At the Lismore Base Hospital.

2 p.m.—General Meeting of the North-Eastern Medical Association.
3.45 p.m.—Registration for Course.
4.15 p.m.—"Functional Pathology of the Kidneys", Professor C. G. Lambie, Professor of Medicine, the University of Sydney.

At the Gollan Hotel, Lismore.

6.45 p.m.—Official Dinner.

At the Lismore Base Hospital.

8 p.m.—"Pain in the Face", Surgeon Captain Lambert Rogers, R.N.V.R., Consultant in Neurosurgery to the Royal Navy, Professor of Surgery, University of Wales.
9.15 p.m.—Film on "Caudal Analgesia".

Sunday, August 5.

At the Lismore Base Hospital.

9.45 a.m.—"Uræmia and Hypertensive Encephalopathy", Professor C. G. Lambie.
11.15 a.m.—"Sciatica", Surgeon Captain Lambert Rogers, R.N.V.R.
2.30 p.m.—"Nephritis", Professor C. G. Lambie.
4.15 p.m.—"The Management of the Patient Unconscious from a Head Injury", Surgeon Captain Lambert Rogers, R.N.V.R.

The fee for the course will be one guinea. There will be no charge for members of the defence forces. Those intending to be present are requested to notify Dr. G. J. Rawle, Honorary Secretary, the North-Eastern Medical Association, Lismore, as soon as possible, and to state whether it is also their intention to be present at the dinner.

Correspondence.

MEMORIAL TO THE LATE DR. F. P. SANDES.

SIR: Having regard to Dr. F. P. Sandes's outstanding record to the University of Sydney as a demonstrator and acting professor of anatomy, as a surgical tutor, lecturer in the principles and practice of surgery, and the McCaughey professor of surgery, as acting director of cancer research, and the director of cancer treatment, to the Royal Prince Alfred Hospital as an honorary surgeon and later honorary consulting surgeon, to the Royal Australasian College of Surgeons as one of its founders and sometime member of the Council, to the New South Wales Branch of the British Medical Association of which he was a past president, we thought that many of his friends would care to subscribe towards a fund which would provide a means of establishing a suitable memorial to him, by which the memory of his services to the community would be fittingly preserved. It has been suggested that the memorial might take the form of a fellowship in surgery, an annual oration, or an annual surgical prize.

If medical practitioners are willing to participate we would welcome their contribution, however small, for we feel that, like ourselves, they held in high regard the high and meritorious service Dr. Sandes has rendered his generation and State in so many spheres.

Mr. Francis H. Way and Mr. A. H. Uther, the honorary treasurer and assistant honorary treasurer respectively of the Royal Prince Alfred Hospital, have consented to act as honorary treasurers for the fund. Cheques, money orders, postal notes *et cetera* should be addressed to either of them, care of Royal Prince Alfred Hospital, Camperdown, to be made payable to the "Dr. F. P. Sandes Memorial" or "Bearer", and be crossed "Not Negotiable".

As we shall be unable to bring this matter to all Dr. Sandes's friends, we would greatly appreciate it if medical practitioners would mention our objectives to those who might be interested, and assure them that we would welcome their cooperation.

Yours, etc.,

J. W. HORNBROOK,
President, Sydney University Medical Society.

W. A. SELLE,
Registrar, University of Sydney.

E. A. TIVEY,
President, New South Wales Branch, British Medical Association.

A. J. COLLINS,
Honorary Secretary, New South Wales Branch, British Medical Association.

H. G. POATE,
President, Royal Australasian College of Surgeons.

HERBERT H. SCHLINK,
Chairman, Royal Prince Alfred Hospital.

Royal Prince Alfred Hospital,
Camperdown,
Sydney.
July 1, 1945.

PHYSIOLOGICAL CONSIDERATIONS IN VASCULAR SURGERY.

SIR: The recent contributions to the journal about the ligation of main arteries have been instructive. But this morning, when I saw the havoc wrought by the recent frost upon the extremities of my broad beans, and when I thought of the gangrene caused by frost-bite in humans, I made up my mind not to pack the limb with ice, as recommended by Surgeon Captain Lambert Rogers, unless he can quote better evidence. Surely he is exceeding the mandate conferred by the experiments of Barcroft and Edholm, which suggest that the limb should be taken out of the hot-air box (104° F.) and left at room temperature, not reduced near to freezing point. Is not moderation always safer?

Yours, etc.,
V. J. KINSELLA.

235, Macquarie Street,
Sydney,
July 10, 1945.

Obituary.

FRANCIS PERCIVAL SANDES.

MANY medical men in practice interest themselves in the affairs of the British Medical Association and of other scientific bodies; numbers also are engaged in medical teaching as members of the teaching staff of a university; others find spheres of interest in medical matters not directly connected with teaching, with science or with medical politics. There must be few whose tastes are so catholic and whose activities are so varied as were those of Dr. Francis Percival Sandes. His death, recorded recently in these pages, brought to its close a career which must have been as crammed full of interest as it was splendid in achievement and freighted with qualities of heart and mind that could not fail to exemplify the best that is in medicine. His learning, his

knowledge of human nature, his generosity of mind and his keen sense of humour combined to fashion a man who will long be held in grateful remembrance.

Francis Percival Sandes was born in 1876 in Queensland. His education was begun at the Brisbane Grammar School. He was a successful scholar and entered the medical school at the University of Sydney on an exhibition which he won in Queensland in 1893. During his student career his success continued. He gained the Renwick Scholarship and the Levey Scholarship; and he won the Slade Prize for practical chemistry and physics. He graduated as Bachelor of Medicine and Master of Surgery in 1899. In those days the degree of Doctor of Medicine could be taken in surgery at the University of Sydney. This Sandes did, being admitted to the degree with first-class honours and the university medal in 1903. After he had been in practice for a few years he sat for and passed with honours in 1913 the examination admitting him to the degree of Bachelor of Science.

After graduation Sandes became resident medical officer at Prince Alfred Hospital (it had not then acquired the title "Royal") and remained for two years. In his second year he was resident pathologist and was also entrusted with some radiological work. The association with the hospital, begun so soon after graduation, was continued later on and lasted until his death. After his senior year in residence at hospital he became demonstrator in anatomy at the University of Sydney. While doing this work he commenced private practice at City Road, not far from the medical school. This practice grew substantially, and eventually he left it for Macquarie Street. As demonstrator of anatomy Sandes showed his ability as a teacher. When Professor "Jummy" Wilson visited the Old Country Sandes acted as professor of anatomy and carried out all the duties connected with the post. There is no doubt that this work was of enormous value to him in his later years. Retiring from the department of anatomy, he became surgical tutor and was associated with Dr. Alexander MacCormick (he had not then been knighted) in the teaching of operative surgery. In February, 1908, Sandes was appointed honorary assistant surgeon at Prince Alfred Hospital. Later he became full surgeon and in due course joined the consulting staff. But his hospital work did not end by his holding of this honourable office. In fact he completed the full circle, and to quote his own words after the outbreak of the present war, he became a "resident" again. So many of the junior men were enlisting for service with His Majesty's Forces that the hospital was hard put to it to maintain an efficient resident staff. Sandes went into residence again and was given the title of "resident consultant". Those who were associated with him in other spheres of activity could not help being struck by the genuine delight that he had in this work. He was associated with young men and thoroughly enjoyed the experience.

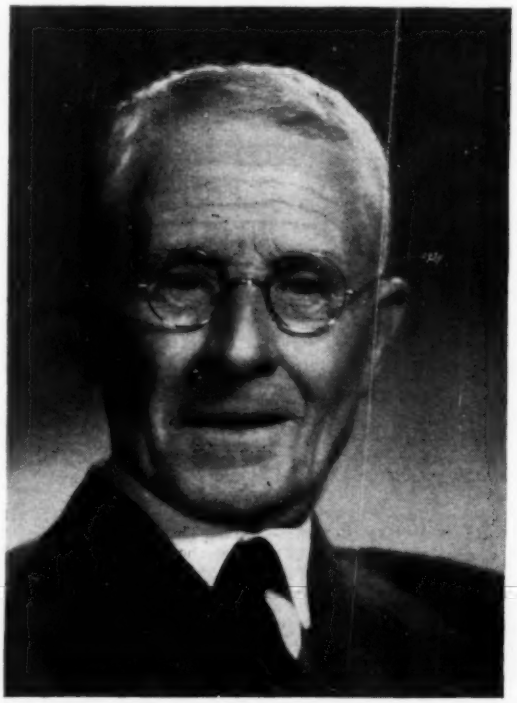
But Sandes had other appointments with the University of Sydney. He was lecturer in surgery from 1915 to 1920 and was appointed the first professor of surgery in 1920, holding the position until 1927. From the year 1921 to 1926 he was honorary secretary of the Cancer Research Committee and in 1927 he became acting director of cancer research. In the following year he was appointed director of cancer treatment and served faithfully and well until 1934. He was also, it should be noted here, one of the founders of the Royal Australasian College of Surgeons.

Sandes's membership of the British Medical Association was long and active. He joined the New South Wales Branch on March 16, 1900. He became a member of the Branch Council in 1911 and in 1913 acted for a period of six months as honorary secretary. In 1913-1914 he took an active part in the negotiations connected with the Friendly Society Common Form of Agreement. In the annual report of the Branch for that year the following words appear:

> The procedure necessary to give effect to the wishes of the members (i.e. Common Form of Agreement) was elaborated with much care and thought. For the successful carrying out of this great undertaking the Branch has to thank the Acting Honorary Secretary, Dr. F. P. Sandes, whose work in this connection entailed very heavy personal sacrifice.

Sandes was chairman of the medical politics committee of the Branch for two years (1918 and 1919). He acted as Branch representative at the Annual Representative Meeting in England in 1910. During the period 1918 to 1920 he was a member of the Federal Committee of the British Medical Association in Australia, and in the first two years of this period acted as honorary secretary and honorary treasurer of the committee.

Sandes had a close association with this journal. He became a member of the Australasian Medical Publishing Company, Limited, in 1916 and was a director from 1923 to 1927. This covers the period when the directors, having decided to enlarge the journal and to expand the operations of the company, left the old British Medical Association Building in Elizabeth Street to occupy the newly erected premises in Glebe known as The Printing House. At this time the late William Nathaniel Robertson, of Brisbane, was chairman of directors. Momentous decisions had to be made and Sandes took his full share of the responsibility of making them. On more than one occasion he acted as chairman in the absence of W. N. Robertson. After Sandes retired from the directorship of the company in 1927 he retained his membership and with it his interest in the welfare of the company and the journal. After his death the directors placed on record their appreciation of his services and their keen sense of the loss that the company, the journal and the profession of medicine had sustained.



The recital of the many offices held by Francis Percival Sandes and of the diverse duties he so willingly and efficiently carried out does not give a real insight into all that he did. He had an influence on the men with whom he worked. They could not fail to realize that his philosophical outlook was based on convictions that were the guiding principles of his life. This is why, as already stated, he will be remembered by all his associates.

DR. L. R. PARKER writes: "To every man upon this earth death cometh soon or late", but there are few deaths in our profession which have caused such widespread sorrow as that of Francis Percival Sandes. No man of his day had a wider medical acquaintanceship. From his student days to the time of his death he maintained continuous contact with the rising and risen medical generations. As university lecturer, demonstrator, examiner and professor of both surgery and anatomy, councillor and president of the New South Wales Branch of the British Medical Association, director of the Cancer Research Institution, Fellow of the Royal Australasian College of Surgeons, honorary and consultant surgeon of the Royal Prince Alfred Hospital and resident consultant there during the wartime dearth of resident medical officers, and finally, concurrent with all these, surgeon consultant in Macquarie Street, his life was spent in a moving stream of medical men and women comprising every age and type in the profession. By all of these he was held in the highest respect, admiration and affection, and it is a great company that will range itself with his family and mourn the passing of "Sandy".

Elsewhere in this journal appears a complete record of Sandes's appointments and distinctions. None of these were achieved by chance or favour, but by hard work and versatile capacities closely akin to genius; and it is a matter of some interest how comparatively hidden from surface observation these remarkable capacities were. Few first guesses based on manner and appearance would have named him to be a distinguished professor and front-ranking surgeon, although a closer scrutiny of the well-shaped dark-grizzled head, keen eyes, firm finely cut features, upright boyish figure, springy step and sober well-made clothes disclosed a distinction of its own. Similarly few first acquaintances would have recognized that behind the youthful grin and humorous persiflage there lay a keen intellect and wide scientific knowledge that embraced a complete familiarity with the higher mathematics, a genius for chemistry and physics especially in relation to radiation radioactivity, and a wide literary equipment which included a fine classical scholarship, discrimination in detective fiction and a familiarity with Shakespeare which provided him with ominous quotations when surgical prognoses were more than usually gloomy. Similarly camouflaged was a fund of common sense so often exhibited for his friends in sound advice; as to myself when meditating a business adventure he once said: "Never, when you are over fifty, buy anything that will keep you awake at night."

It may seem presumptuous for a general practitioner to discuss Sandes as a surgeon, but there can be no Hamlet without a Prince of Denmark, however poor the presentation. That he was my consultant for choice in all adult surgery is a measure of my admiration; and the highest tribute (in common with many others in general practice) is that my mind was at rest from the moment he took over surgical responsibility. He lived up to his own dictum that surgical judgement transcended surgical technique, and consisted not only in knowing "when to go in, but also when to get out". His intimate knowledge of anatomical whereabouts led to quick cutting and dissection with edge of scalpel and cutting points of scissors. His narrow hand with long sensitive dexterous fingers was never at fault within or without. He was quick without haste, neat without effort. Control of himself or a strenuous situation never faltered. Incidentally he was considerate to his anæsthetist, and all theatre staffs welcomed him gladly. Every obscure surgical problem intrigued him enormously. He was happiest when making his dexterous way along an uncharted or perilous route to a relatively remote or microscopic destination. A hospital colleague recently said that whenever some surgical mystery was afoot, some hidden enemy to be dislodged, the cry of the staff was for "Sandy". At the Cancer Institute his ingenuity in carrying radium to more inaccessible regions of the body was a constant source of amusement to the staff. His surgical courage was a major virtue, although it is well illustrated by a minor operation on a small child, on whom, at a parental whim, he had done a dorsal incision instead of a complete circumcision. A secondary infection had arisen; and, as together we inspected the small but terrifying object, my own heart sank; but Sandes, without a word, signed for an anæsthetic, and unaided, rapidly trimmed the inflamed flaps into a perfect circumcision, concluding with a cheerfully confident "we must leave the rest to God, doctor". Despite the risk of open lymphatic spaces and migrating cocci, he had refused the less responsible but more prolonged expectant treatment and incidentally reaped the full reward of his courage and judgement. His surgical outlook was eminently practical; hence his repeated admonition regarding cast-iron diagnoses and prognoses "always keep the back door open"—also his statement that he did not mind much who removed his appendix or even extracted his gall-bladder, but he would take good care in choosing a surgeon to cut out his piles.

No picture of Sandes is authentic which does not do full justice to his fine sense and exposition of humour. His animated expression, genius for narrative, clever mimicry, facile vernacular and an inexhaustible repertoire of reminiscence made him a *raconteur* almost unrivalled. At all times, places and under most circumstances he was able and willing to exercise his talent for the edification and entertainment of his listeners, but most of all he was in his element at the medical table of the old University Club where he and certain kindred spirits regularly forgathered, and medical chatter scintillated so brightly, that the two most brilliant leaders of the contemporary bar forsook their more venerable clubs to sit in this unwonted but exhilarating atmosphere—one to contribute to the gaiety, the other as a grave and saturnine listener. Surely it is not out of place here to recall "Sandy" exercising his undoubted art, and with what effect, in this familiar setting. The typical reminiscence concerned colleague Sidney Jones, who Christian-named his proletarian patients and was "Sid" in turn to them; and who, one Sunday morning in a dark back room, with Sandy anæsthetizing (joint fee one guinea), was curetting in the light provided by a penny-in-the-slot gas meter, which *in medias res* expired, thereby compelling Sandes to withdraw the anæsthetic, and penniless husband Bill, frantically urged by "Sid", to rush out and borrow a copper. In the subsequent illumination a rapidly recovering patient was disclosed just in time to permit Sandy to escape from line of oral fire and thereby enable her to use Sid's Sunday silk hat on a bedside chair for a purpose never foreseen by the most enterprising hatter. The artistic manipulation of this bare theme embellished by a rich mimicry of the Sid-*cum*-Bill dialogue *re* venue, fee *plus* loan transaction, was so irresistible that at the salty climax the whole table collapsed, and most completely, the saturnine K.C., whose convulsed and glistening features irresistibly recalled the Orphean lyre whose magic strains "drew iron tears down Pluto's cheeks".

Sandes's attitude towards his associates and patients was a wise compound of generosity and common sense. He contrived that all his juniors should receive the maximum operative experiences, holding that his successors must be fully trained even at some risk, his share of which he cheerfully carried. He set examinees at ease in order that they might fairly show what they knew in the rigours of the viva voce. Yet he was no "yes man" to a low standard, as a certain student discovered who gaily suggested summary laparotomy for a certain set of abdominal symptoms. Asked would he accept similar measures for himself, the student hedged and was sent down by Sandes for six months to consider the injustice of not doing surgically as he would be done by. Sandes's comment on the episode was: "Examiners must take care whom they let loose on the public." Regarding patients, although his frequent quotation was "a labourer is worthy of his hire", few surgical labourers have forgone more hire than he. He operated frequently, with no hint of obligation, for little or no charge, and incidentally, if any other arrangements were possible, he did not use public hospitals to save himself time and responsibility, holding that these institutions were for the poor and needy and not to shelter surgeons. His operation fees were not routine nor based on ultimate benefit to patient. "Rather", he said, "fees should depend on what the surgeon himself gives to the operation; and which", he added, "is often little enough."

Sport was no mere sideline with Sandy, and engaged thereon he apparently had no other interest or ambition in life. Motor-cycling, sailing, fishing and tennis were main strings, but none are possible of discussion apart from his inseparable companion, Cyril Shepherd. On their cycles—which both could dismember and reassemble to the last split pin—these two experts raced over every road in the State in an unceasing atmosphere of back-chat, personal derision and recrimination. They incessantly stole marches on each other. One would start before the other was ready, or unexpectedly race ahead for first bath or best bed, and the later opportunity of jibing at the other's inferior machine and snail-like progression. Should one be held up, the other promptly deserted him. Knowing his mechanical support was superfluous, he ostentatiously withheld the moral variety, and was only too delighted to utilize the incident in the next passage at arms.

Sailing activities were similar. They were both good yachtsmen, yet they agreed on nothing—sails to be set, direction of wind, course to be taken or rate of progress. From opposite ends of the boat they taunted and vituperated each other so realistically that on one superlative occasion, after disembarkation, their ancient deckhand hastened to Shepherd's home to warn that the worst had happened, disaster was complete, physical violence probably in progress. His astonishment can be imagined when a gently opened door disclosed the two combatants side by side hilariously discussing the contents of their whisky glasses and the joyous events of the afternoon. Their fishing deportment is unknown to me, but as both were rod experts and caught both sea fish and trout, it must have been more restrained; but tennis was in the usual vein, derision as opponents, utter condemnation as partners. It is hardly necessary to say that a peculiarly strong friendship underlay this verbal camouflage. Their admiration and affection for each other was unbounded, and they were one another's consultant surgeon and family attendant to the time of Shepherd's death. Should this friendship seem unduly emphasized, the defence is a firm belief—not unfounded—that Sandes himself would wish the emphasis. Furthermore, there is no phase of his existence which so clearly displays

his essential quality of eternal youth without which no picture of him should be drawn.

Space forbids more than passing mention of other special qualities of courtesy, punctuality with colleagues, and complete modesty regarding his brilliant career; and this inadequate record finally passes to a less tangible characteristic, one seen and felt but not easily defined—something a little gallant and debonnaire—a legacy perhaps of his "salad days". Although doubtless partly physical, those seeing him in his last illness poignantly recognized that this quality went deeper and was integral to his moral and spiritual make-up. For with his faculties unclouded by pain, anodynes, or insidious toxæmias, no one more than he could have known the significance of his condition and its ultimate destination; nevertheless his interests and conversational repertoire were undiminished, his courage steadfast without parade and his humour unconquerable. What struck everyone—and not without a pang—was that this reader of riddles and master of problems derived the utmost amusement and satisfaction from the knowledge that his own condition was an enigma to his attendants. In the later stages the only perceptible change was that his conversation became more reminiscent and the reminiscences themselves slipped farther backward in point of time. At the end this scholar, teacher, beloved physician and good companion lay unconscious for several days, and during that dim period between life and death, it does not seem hard to imagine his questing spirit moving expectantly forward to the solution of its last and greatest problem. In solving it, he has left a gap which no one can fill and few or none of us will see his like again.

WILLIAM EDWARD TULLOH.

WE regret to announce the death of Dr. William Edward Tulloh, of Murrumbeena, Victoria, which occurred on July 6, 1945, at Melbourne.

Naval, Military and Air Force.

APPOINTMENTS.

THE undermentioned appointments, changes *et cetera* have been promulgated in the *Commonwealth of Australia Gazette*, Number 130, of July 5, 1945.

NAVAL FORCES OF THE COMMONWEALTH.

Permanent Naval Forces of the Commonwealth (Sea-Going Forces).

Appointments.—Surgeon Commanders Denis Adrian Pritchard and Lionel Lockwood, M.V.O., D.S.C., are appointed Honorary Physician and Honorary Surgeon, respectively, to His Royal Highness the Governor-General, dated 2nd June, 1945.

Termination of Appointments.—The appointments of Surgeon Commander (Acting Surgeon Captain) Alexander Scott Mackenzie and Surgeon Commander David Shields Prentice as Honorary Physician and Honorary Surgeon, respectively, to His Royal Highness the Governor-General are terminated, dated 1st June, 1945.

Citizen Naval Forces of the Commonwealth.

Royal Australian Naval Reserve.

Appointments.—Gerald Brosnan and Gordon Seymour Murray are appointed Surgeon Lieutenants, dated 29th May, 1945.

Nominations and Elections.

THE undermentioned have applied for election as members of the New South Wales Branch of the British Medical Association:

Gibbons, Claude Lamb, M.B., B.S., 1940 (Univ. Sydney), Squadron Leader C. L. Gibbons, Royal Australian Air Force, Victor Harbour, South Australia.

Knight, Ronald Victor, provisional registration, 1945 (Univ. Sydney), Royal North Shore Hospital, St. Leonards.

McDonald, Geoffrey Lance, provisional registration, 1945, B.A., 1941 (Univ. Sydney), Royal Prince Alfred Hospital, Camperdown.

Hughes, Herbert Leslie, M.B., B.S., 1939 (Univ. Sydney), Captain H. L. Hughes, 115 Military Hospital, Heidelberg, Victoria.

Nolan, Marcella Therese, provisional registration, 1945 (Univ. Sydney), Royal Prince Alfred Hospital, Camperdown.

Lowe, Betty Marjorie, M.B., B.S., 1944 (Univ. Sydney), Eastern Suburbs Hospital, Bondi Junction.

Diary for the Month.

JULY 24.—New South Wales Branch, B.M.A.: Ethics Committee.
JULY 25.—Victorian Branch, B.M.A.: Council Meeting.
JULY 26.—South Australian Branch, B.M.A.: Scientific Meeting.
JULY 26.—New South Wales Branch, B.M.A.: Branch Meeting.
JULY 27.—Queensland Branch, B.M.A.: Council Meeting.
AUG. 1.—Victorian Branch, B.M.A.: Branch Meeting.
AUG. 1.—Western Australian Branch, B.M.A.: Council Meeting.
AUG. 2.—South Australian Branch, B.M.A.: Council Meeting.
AUG. 3.—Queensland Branch, B.M.A.: Branch Meeting.
AUG. 7.—New South Wales Branch, B.M.A.: Organization and Science Committee.
AUG. 10.—Queensland Branch, B.M.A.: Council Meeting.
AUG. 13.—Victorian Branch, B.M.A.: Hospital Subcommittee.
AUG. 13.—Victorian Branch, B.M.A.: Finance, House and Library Subcommittee.
AUG. 14.—Tasmanian Branch, B.M.A.: Ordinary Meeting.

Medical Appointments: Important Notice.

MEDICAL PRACTITIONERS are requested not to apply for any appointment mentioned below without having first communicated with the Honorary Secretary of the Branch concerned, or with the Medical Secretary of the British Medical Association, Tavistock Square, London, W.C.1.

New South Wales Branch (Honorary Secretary, 135, Macquarie Street, Sydney): Australian Natives' Association; Ashfield and District United Friendly Societies' Dispensary; Balmain United Friendly Societies' Dispensary; Leichhardt and Petersham United Friendly Societies' Dispensary; Manchester Unity Medical and Dispensing Institute, Oxford Street, Sydney; North Sydney Friendly Societies' Dispensary Limited; People's Prudential Assurance Company Limited; Phœnix Mutual Provident Society.

Victorian Branch (Honorary Secretary, Medical Society Hall, East Melbourne): Associated Medical Services Limited; all Institutes or Medical Dispensaries; Australian Prudential Association, Proprietary, Limited; Federated Mutual Medical Benefit Society; Mutual National Provident Club; National Provident Association; Hospital or other appointments outside Victoria.

Queensland Branch (Honorary Secretary, B.M.A. House, 225, Wickham Terrace, Brisbane, B.17): Brisbane Associated Friendly Societies' Medical Institute; Bundaberg Medical Institute. Members accepting LODGE appointments and those desiring to accept appointments to any COUNTRY HOSPITAL or position outside Australia are advised, in their own interests, to submit a copy of their Agreement to the Council before signing.

South Australian Branch (Honorary Secretary, 178, North Terrace, Adelaide): All Lodge appointments in South Australia; all Contract Practice appointments in South Australia.

Western Australian Branch (Honorary Secretary, 205, Saint George's Terrace, Perth): Wiluna Hospital; all Contract practice appointments in Western Australia. All Public Health Department appointments.

Editorial Notices.

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